SCIENTIFIC AMERICAN

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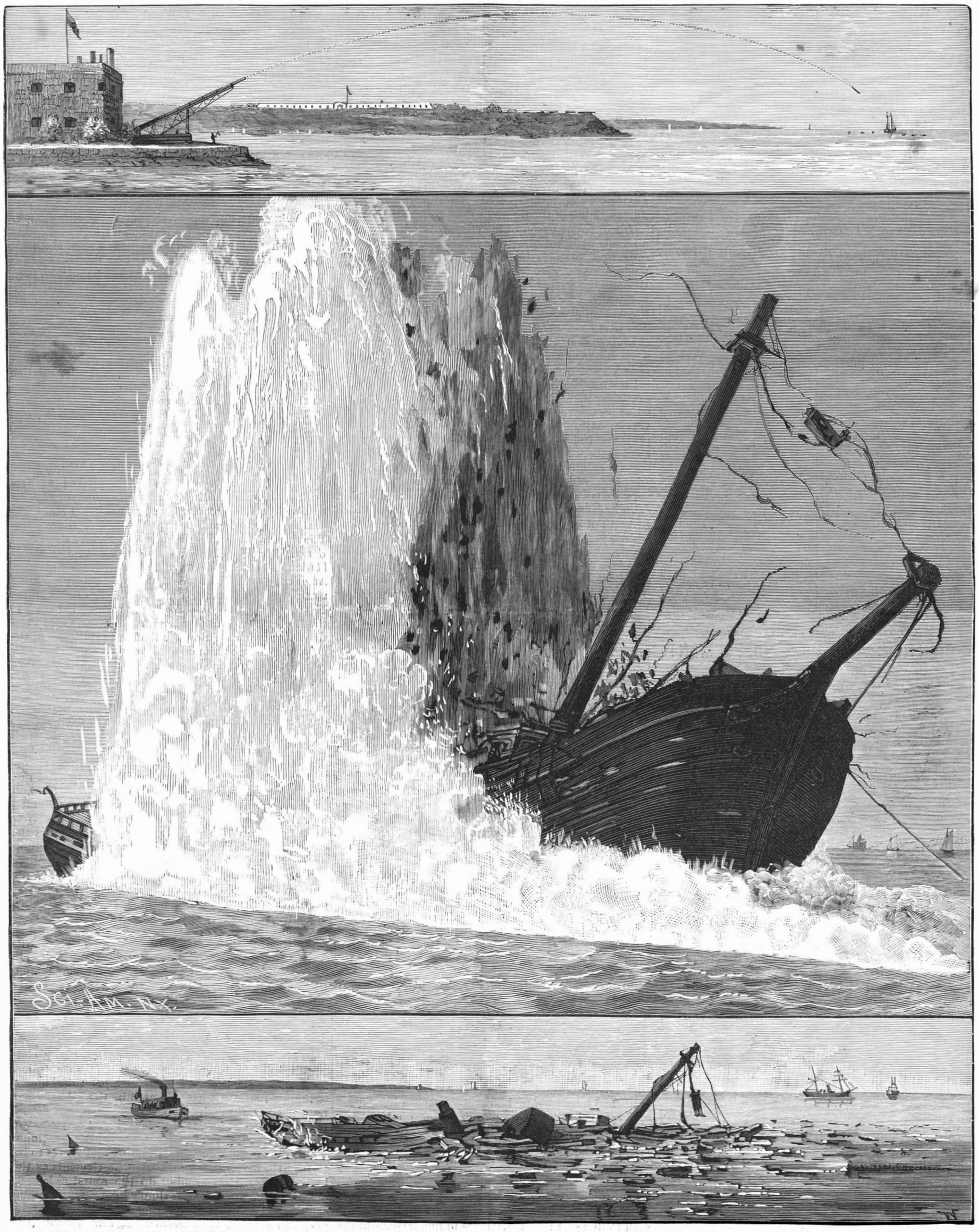
A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LVII.—No. 14. [NEW SERIES.] NEW YORK, OCTOBER 1, 1887. [$3.00 per Year.



PRACTICAL EXPERIMENTS WITH THE PNEUMATIC DYNAMITE GUN.—BLOWING UP A VESSEL IN NEW YORK HARBOR.—[See p. 214.]

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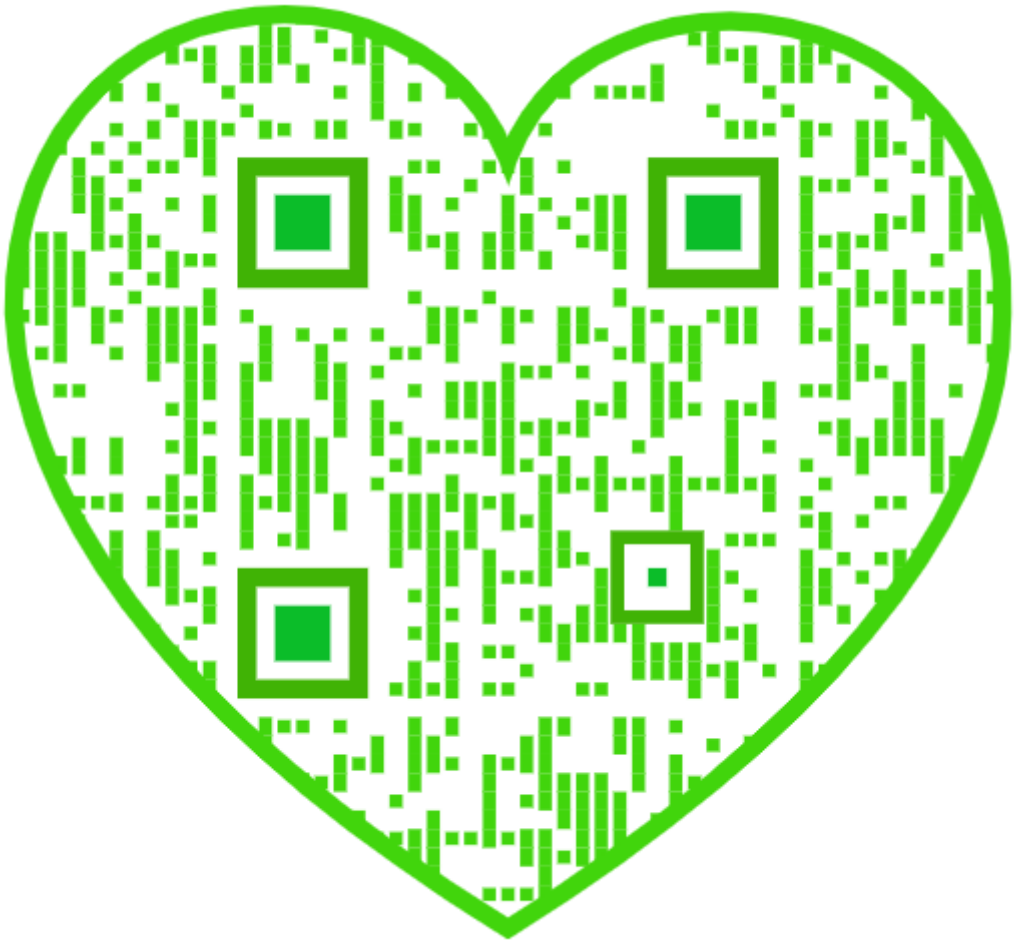

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

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NEW YORK, SATURDAY, OCTOBER 1, 1887.

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THE CENTENNIAL OF THE SIGNING OF THE CONSTITUTION OF THE UNITED STATES.

Mr. William E. Gladstone has given it as his opinion that the Constitution of the United States is the most remarkable work produced by the human intellect in modern times. The centennial of the signing of this instrument was celebrated with great pomp in Philadelphia on September 15, 16, and 17, 1887. The President of the United States and his wife, members of the judiciary, State governors, members of the cabinet and of the houses of Congress, army officers, many church dignitaries, and other notabilities were present. The vessels of the North Atlantic squadron of the U.S. navy, five in number, sailed up the Delaware and anchored off Fairmount Avenue. The city was decorated with bunting, and every available spot was utilized by sightseers. All around the public buildings several ranges of staging were carried, which were filled with chairs, providing alone for the accommodation of many thousands. Arrangements had been made to provide for accidents. The fire department was kept ready for instant response to alarms. The ambulances were in readiness to answer any calls. The hospitals made special preparations, and quantities of bandages and similar supplies were sent to them by some of the large business houses. Fortunately these preparations were not needed, as owing to good organization the great display passed off with very few accidents. It included processions, receptions, speeches by the President, by Justice Miller of the Supreme Court, and others.

The different trades of the city made a fine display in a parade upon the first day; workmen executing the operations of their trade, both in the old and in the modern ways, were carried on floats or great trucks through the streets. The Carpenters' Club bore a banner which ninety-nine years ago had been carried in the first anniversary of the framing of the Constitution. The portion of the parade occupied by this display of the industries of the country was very long, and took over an hour to pass a given point. The military parade took place upon Friday, and General Sheridan led the march, the famous Marine Band of Washington preceding it, and the different State governors appeared as participants. Finally, upon Saturday, the anniversary day of the signing, the closing exercises took place in Independence Square. An immense stage erected there was filled with 15,000 people, while on the street an audience of 30,000 patiently stood during the addresses, which but few could hear.

The chairman of the Centennial Commission, Mr. John A. Kasson, after calling for silence, during which Bishop Potter pronounced an invocation for the nation, addressed the assemblage. He was followed by the President and Justice Miller. The latter delivered a long and carefully prepared address upon the Constitution. After some further addresses and singing of "Hail Columbia," with additional stanzas by Oliver Wendell Holmes, a new national hymn, by J. Marion Crawford, was recited by Professor Murdock, the elocutionist. Then Cardinal Gibbons, of Baltimore, in full canonicals, recited a prayer, terminating the proceedings by his benediction.

The number of people who participated in the different parts of the display cannot be estimated. It is doubtful if so extensive a celebration of this nature has been seen in this country. As a lesson in the organization of such proceedings, the successful carrying out of the three days' programme, with the liberal provision for spectators, is not without value.

Our readers should not forget that in this celebration was included the anniversary of the foundation of our patent system. In the Constitution are those famous articles on which the patent statutes were based, and on which their weight reposes. Three hundred thousand defined inventions, with all the incidental unpatented inventions which they have led to, and with the unprecedented development of American industries, fostered and brought on by them, all repose upon these few sentences of the Constitution. Little allusion to this can be found in the proceedings, but the great labor parade, with its contrast of the old and new methods, was the noblest tribute, if an indirect one, that could have been rendered. When the time for the centennial of our patent system shall come, the country will be presented a display in its essentials the most impressive ever yet witnessed.

POSITIONS OF THE PLANETS IN OCTOBER.

VENUS

is morning star, and is a superb object in the morning sky, rising on the first of the month about an hour and a quarter before the sun, and at its close nearly two hours and a half before him. She reaches her period of greatest brilliancy as morning star on the 28th, when she may be seen in full daylight. Venus rises on the 1st at 4 h. 48 m. A. M.; on the 31st, she rises at 3 h. 2 m. A. M. Her diameter is 57·9″, and she is in the constellation Virgo.

SATURN

is morning star, and is easily found making his way among the small stars of Cancer, and forming a triangle with Pollux and Procyon. He is in quadrature on the 29th, being at that time 90° west of the sun. Saturn rises on the 1st at 12 h. 21 m. A. M.; on the 31st, he rises at 10 h. 31 m. P. M. His diameter on the 1st is 16·6″, and he is in the constellation Cancer.

MARS

is morning star. He is near the bright star Regulus on the 10th, and may be readily seen in the small hours of the morning of that day as a small, ruddy star north of his brighter companion. Mars rises on the 1st at 1 h. 50 m. A. M.; on the 31st, he rises at 1 h. 24 m. A. M. His diameter on the 1st is 4·8″, and he is in the constellation Leo.

NEPTUNE

is morning star. He is near opposition, near his least distance from the earth, and in excellent position for telescopic observation. He may be found about 5° south of the Pleiades. Neptune rises on the 1st at 7 h. 51 m. P. M.; on the 31st, he rises at 5 h. 49 m. P. M. His diameter on the 1st is 2·6″, and he is in the constellation Taurus.

URANUS

is evening star until the 6th, and then morning star. He is in conjunction with the sun on the 6th, rising and setting with the sun at that time, and being at his greatest distance from the earth. Uranus sets on the 1st at 5 h. 41 m. P. M.; on the 31st, he rises at 4 h. 20 m. A. M. His diameter on the 1st is 3·4″, and he is in the constellation Virgo.

JUPITER

is evening star, and sets so soon after the sun that he will soon become invisible. He makes a close conjunction with Alpha Libræ on the 26th, at 1 h. A. M., being 34′ north of the star. Jupiter sets on the 1st at 6 h. 44 m. P. M.; on the 31st, he sets at 5 h. 3 m. P. M. His diameter on the 1st is 30″, and he is in the constellation Libra.

MERCURY

is evening star. He reaches his greatest eastern elongation on the 27th at 3 h. A. M., and is 23° 58′ east of the sun. He is far enough from the sun at that time to be visible to the naked eye, but his southern declination will make him a difficult object to find. Mercury sets on the 1st at 6 h. P. M.; on the 31st, he sets at 5 h. 34 m. P. M. The diameter of Mercury on the 1st is 5″, and he is in the constellation Virgo.

An Arrival of Cholera at New York.

On Sept. 23 the steamship Alesia arrived at New York from the Mediterranean with four passengers sick with Asiatic cholera, there having been eight deaths on board from the disease during the voyage. The ship sailed from Marseilles Aug. 29, and stopped at Genoa, Leghorn, Naples, and Palermo, taking on 561 Italian emigrants, and having aboard in all 609 persons. After the vessel had arrived at the regular quarantine station, which is some six miles below the lower end of New York City, no time was lost in turning her back to the Lower Bay, and putting the passengers and crew under the strictest rules to cut off all possibility of the epidemic being communicated from the ship. The sick were landed on one of the small quarantine islands there, and put in a hospital for contagious and infectious diseases, and the others were placed in an observation hospital, to be detained from ten to twenty days, or until all danger is supposed to be over.

The ship has been thoroughly washed and fumigated, and the cargo and baggage put through a special process of cleaning by sulphurous acid gas, in much the same way as rags are disinfected. The cholera has prevailed for many weeks past at Genoa, Naples, and Palermo, there being many new cases daily at Naples, of which 70 per cent were proving fatal, but the New York health authorities have no apprehension that the disease will obtain a foothold here, so prompt and thorough has been the action of the department, while President Baylies, of the Health Department, is of the opinion that cholera in New York City is not as bad as diphtheria. There were cholera epidemics in New York city in 1832, 1834, 1849, 1854, and 1866. Deaths from the disease in those years are as follows: 1832, 3,513; 1834, 971; 1849, 5,071; 1854, 2,509; 1866, 1,137. Most of the deaths were in tenement houses, and the disease obtained its strongest hold in the vicinity of bone-boiling and fat-rendering places. In other parts of the city it yielded readily enough to sanitary measures.

An Electric Whistle.

M. Zigang has devised a trumpet worked by electricity and designed to warn or signal vessels, trains, or tram cars. It consists of a trumpet tube and a sounding plate which is vibrated by the electric current passing through an electro-magnet having its poles close to a soft iron armature carried by the plate. A regulating screw contact, with a platinum point, rests against the iron armature and serves to interrupt the current of two Leclanche elements as the plate vibrates, thus keeping up the sound as long as desired. The apparatus is simple in construction and can be used also as a Morse sounder in receiving telegraphic messages, the current being sent through the electro-magnet.

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The New Commissioner of Patents.

The N. Y. *Tribune* concludes that the new Commissioner of Patents, Benton J. Hall, of Iowa, is about as hard-working an officeholder as any this administration has discovered. He climbs up the Patent Office steps every morning as the clock strikes nine, and often stays until long after four o'clock. The slippery chairs and sofas which adorn the commissioner's office are held down continually by attorneys, waiting to transact their business with the office, in place of the former crowds of reform congressmen with Democratic principles and good-looking young women whom they wanted to get into office. The commissioner has made some effort—though not so strenuous as might be—to cut the deadwood out of the examining and clerical forces left him as a legacy by his predecessor. In brief, he seems to recognize the fact that the Patent Office is not a political office, that it is supported by the money of a particular class, the inventors. So well supported, in short, that a yearly dividend of twenty per cent is realized from the fees paid in, while there is an accumulated surplus of $3,000,000 in the Treasury. Every week's issue of the *Official Gazette* contains from one to three of the commissioner's decisions on points of office practice, tending to bring about uniformity in the same among the different divisions. If the stories told by the attorneys are to be believed, something of that kind is badly needed. The office is slowly catching up with the work, but no great gain can be expected, I am told, with the present force. While the number of laborers in the patent vineyard remains stationary, the crop of applications is growing heavier every day. The coming Congress ought to do something to remedy the existing state of things.

And the editor might have added that a great injustice has been done inventors and others transacting business with the Patent Office, owing to the indifference of congressmen in past sessions of legislation. The encomium of the *Tribune* upon Commissioner Hall is just, and reminds one of the Patent Office administration under the commissionership of Judge Mason and Judge Holt, which was a good while ago, but whom a few of us live to remember with satisfaction.

Chilled Armor for Land Defenses.

The Gruson Works of Buckau-Magdeburg have recently published a book of some size, written by Engineer Von Schuetz, in which the system of construction of chilled cast iron armor for use in the protection of earthworks and in the making of turrets for land batteries, as devised by Dr. H. Gruson, some years ago, is described at length, and an account is given of the results of the experiments which have been made, from time to time, by several European governments, to determine its efficiency in resisting the impact of the heaviest modern ordnance. This work has been translated into English by Commander Grenfell, R.N., and we are indebted to the courtesy of Captain Piorkowski, Dr. Gruson's representative in this country, for an early copy. The subject and the matter of the work are of exceedingly great importance to a nation which, as is the case with our own, is destitute of the most ordinary means of defense in the event of a foreign attack either by land or sea. So serious is our case that, as remarked in a private letter from the admiral of the navy, just received and lying under the hand of the writer, if we desire to learn what advances have occurred during the last twenty years, we must go to England, France, Germany, Russia, and even to Constantinople, to study those of the scientific and mechanical departments of the military and naval establishments, and not to our own army or navy. This work of Dr. Gruson would seem to illustrate such advances in the defense of coasts.

Dr. Gruson's armor is simply a chilled cast iron shield, of which the body is a strong normal iron, while the surfaces on the exposed side are chilled like the "tread" of an American car wheel. Such enormous masses are handled, in this case, however, that correspondingly enormous chills are needed, and the manufacture of these plates becomes a matter of extraordinary difficulty and cost. All the resources of a great establishment are drawn upon, and all the ingenuity, knowledge, and experience of an able staff are called out in the prosecution of the work. Chilling, as is well known, probably, to most of our readers, consists in the casting of a peculiar quality of cast iron, known as "chilling iron," in contact with a large mass of cold iron forming that part of the mould which is to form the surface to be chilled. The sudden abstraction of heat prevents the isolation of the carbon in graphitic form, as would otherwise occur in the slow process of cooling naturally, and insures its retention in the combined form, producing a steel layer of considerable depth. The depth so secured is dependent upon the quality of the iron and the efficiency of the "chill," as the iron mould is called. The latter must have great thickness and good conducting power to give best results in these applications. Successfully carried out, this process gives a surface harder than tempered steel over a strong and massive interior, the best possible combination, apparently, for an armor plate.

Dr. Gruson constructs large fixed turrets and land batteries of such plates, and the results of trial indicate them to be more reliable defenses than any wrought metal, whether iron or steel, or "compounded," yet introduced. The weight of these shields is too great for use in naval construction. The first trials were made in 1869, at the Tegel range, and it was found that all shots fired against the chilled plates broke into fragments, and that the plates bore the hammering with remarkable success. The experimental committee reported that the chilled armor was well adapted for its use. Later trials confirmed this opinion, and the Prussian government at once gave directions for its adoption in important lines of frontier defenses, and Austria, Italy, and Holland followed its example. In all these trials the chilled iron shot were found superior, if well made, to any steel shot, except in one or two cases in which makers like Krupp and the Ternitz company had either succeeded in securing an exceptional quality of steel or had found remarkably effective methods of tempering. Plates were tested of from 13·77 to 49·21 inches thickness, and were attacked by guns varying from 6 to 17 inches caliber, throwing shot weighing from 61 to 2,205 pounds. The thickness of plate was usually not far from three times the diameter of the bore of the gun to be resisted. The energy of impact was, in the case of the largest gun, over 47,000 foot-tons, which was only obtained, however, by firing at short range—150 yards. In all such cases, the shield is subjected to more severe trial than would be likely to be met in actual battle. In trials last year at Spezia, with the 100 ton gun, the shot weighed a ton and the powder charge 327 pounds, the velocity of impact being over 1,700 feet per second. The maximum penetration was four inches, the plates finally breaking up under repeated blows.

The method of proportioning is to give the plates a maximum thickness in inches equal to from one-fourth to one-third the fourth root of the energy of the attacking shot measured in foot-tons. The total weight of each plate of which the armor is composed is not far from the weight of the gun expected to be used in the attack.

The system of defensive armor here described is one in which we have a peculiar interest. We have in the United States, in the "Salisbury," and "Hanging Rock," and other brands, the best chilling irons in the world, and it would seem very possible that this may prove to be the best system for our purpose yet devised. It is especially one which we may hope to obtain permanent advantage from, as it seems probable that its advantages over other forms are not likely to be soon lost.—*R. H. Thurston, in Science.*

How to Get Rich.

In answer to a request of the Boston *Herald* to write some practical hints for young men on the acquirement of wealth, Gen. Benj. F. Butler responds as follows:

A difficult task is set me, as circumstances under which young men commence life are so widely varied. But I think that more young men fail in the investment of what they earn or receive than in any other way to acquire property. The temptations to speculate are so great, and the desire to become suddenly rich so strong, that I believe eight out of ten, if not more, of young men are wrecked at the very beginning.

If a young man is earning something more than the expense of his living, and has no object in view, he is likely either to increase those expenses carelessly or to loan his money to his friends, and in so doing in the majority of cases he will lose both friends and money. So that the best thing that he can do is to have an object, gather up his money, and to have a call for it which shall be a profitable one. He makes no investment because he says, "I have got so little money that it won't come to anything. I will wait until I get more;" and in waiting, generally, what he has goes.

When a young man has a very little money, let him buy some property, preferably a piece, however small, according to his means, of improved real estate that is paying rent. He had better buy it when sold at auction, under a judicial sale, paying in cash what he can, giving his notes for the balance in small sums coming due at frequently recurring intervals, secured by a mortgage on the property, and then use all his extra income in paying up those notes. It is always safe to discount your own note, and if the notes come a little too fast, as soon as he gets anything paid his friends will aid him when he is putting his money where it cannot be lost, and where the property is taking care of the interest, and in a very short time he will find that he has got a very considerable investment. He will become interested in it, save his money to meet his notes, and he will directly come into a considerable possession of property, and hardly know how it came to him. That is, he will have had a motive for saving, and will get the result of that saving, and will not be tempted to enter into speculations. Nothing is so safe for an investment as improved real estate. Nothing is likely to grow in value faster. In the last 50 years 90 per cent of all the merchants and traders in Boston have failed. In the last 50 years 90 per cent of all the business corporations have failed or gone out of business, so that their stock has been wiped out. In the last 50 years all the improved real estate on the average has paid its interest and taxes and quadrupled in value. If a young man's father can give him anything to start him in the world, he had better invest it in that way and let it accumulate and earn his living, and he will be richer than if he had gone into business. Jay Gould is said to have started from a mouse trap seller to become a millionaire. Assuming that to be true, he is only one of 60,000,000 of people; and if any young man thinks that he is going to imitate Jay Gould, there are 60,000,000 chances to one that he won't succeed.

The rule I would lay down for a young man is, never do a mean thing for money. Be prudent and saving of your money. Be careful to have no interest account running against you, unless you have an equal or greater interest account running in your favor. Work diligently, and you are sure of a competency in your old age; and as early as possible, if you can, find a saving, prudent girl who has been brought up by a mother who knows how to take care of a house, and make a wife of her. She will aid, and not hinder you.

I claim no originality in this advice, and will relate you an incident in my own experience to illustrate it: In my earliest practice in my profession I was quite successful in earning money, and I had a small balance in the Lowell Bank, at the head of which was Mr. James G. Carney. The bank was directly across the hall from my office. I stepped into the bank to deposit a little money on one occasion, and Mr. Carney said to me: "Why don't you invest your money?" "Invest," said I; "I have nothing to invest." "Oh, yes," he says; "you have quite a little sum of money, and I see that your young friends come with your checks occasionally, evidently borrowing it. Now you had better invest it." "How can I invest it?" "Invest it in real estate." "I know nothing about real estate." "Go to the first auction and buy the property. You cannot be much cheated in that, because you will have to give very little more than somebody else will be willing to pay for it. Give your notes for it, save your money, collect your fees, pay your notes as they become due. See that the property is improved property, so that the rent will keep down your interest account, and when you get any other money, invest it in the same way, and if your notes press upon you a little faster than you can pay them, why we will, when we find that is what you are doing with your money, discount your note and give you a little more time, so that you can pay it up. This will necessitate the prompt collection of your bills, for I know that you would rather work and earn a hundred dollars than dun a man for it, unless you have a pressing need for it. You have not even asked for a little bill that we owe you in the bank, which shows me that you do not promptly collect your dues." I followed the advice and bought a number of pieces of property in that manner, and I never did exactly know how they were paid for, but they were, and in a few years I owned some twenty different pieces of property in Lowell that came to me in that way. I can only say that I wish I had been wise enough to have continued this course through life.

I do not think that I need to extend these suggestions any further, because if a young man won't mind these, he won't any others, and I cannot suggest any better ones. I am, yours truly,

BENJAMIN F. BUTLER.

Farming by Gaslight.

Howard County farmers residing in the vicinity of the great Shrader gas well, near Kokomo, Indiana, go on record as harvesting the first wheat by natural gaslight. A dozen self-binders and men shocking wheat was truly a novel scene, which was witnessed by hundreds of people, who surrounded the fields of grain in carriages. The constant roar of the Shrader well can be distinctly heard eight miles away, while the light can be plainly seen at Burlington, fifteen miles west of here. The estimated flow of gas from this well is 15,000,000 cubic feet every twenty-four hours.—*Indianapolis Journal.*

Steam Pipe for Heating Purposes.

The *Master Steam Fitter* gives the following rule for finding the superficial feet of steam pipe required to heat any building with steam: One superficial foot of steam pipe to six superficial feet of glass in the windows, or one superficial foot of steam pipe for every hundred square feet of wall, roof, or ceiling, or one square foot of steam pipe to eighty cubic feet of space. One cubic foot of boiler is required for every fifteen hundred cubic feet of space to be warmed. One horse power boiler is sufficient for forty thousand cubic feet of space. Five cubic feet of steam, at seventy-five pounds pressure to the square inch, weighs one pound avoirdupois.

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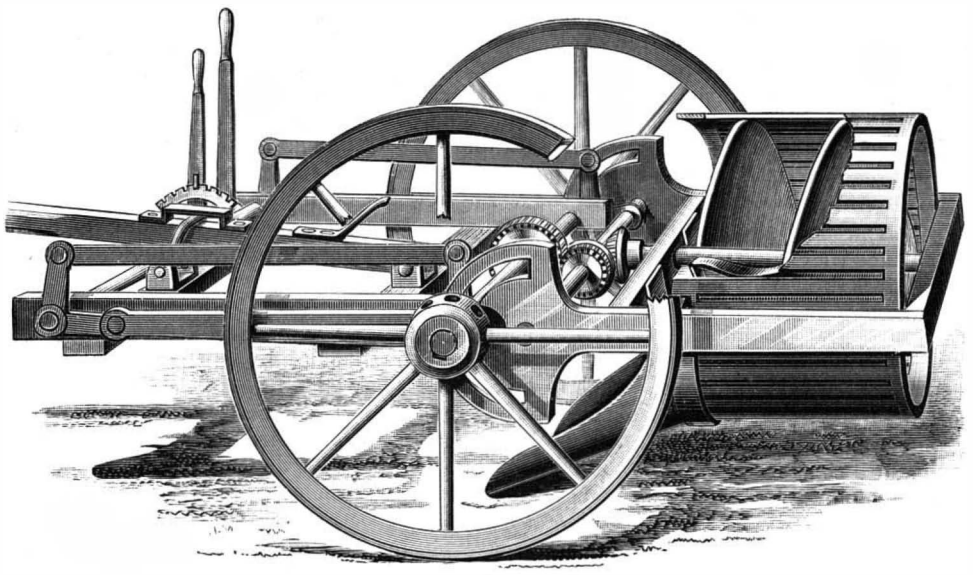
AN IMPROVED POTATO DIGGER.

A machine designed to be drawn by two horses, and to dig the potatoes in a row, irrespective of the contour of the ground, delivering them at the rear, separated from weeds and dirt, is shown in the accompanying illustration, and has been patented by Mr. Asa C. Collins, of Driftwood, Cameron County, Pa.

A rearwardly extending frame which supports a cage-like structure is carried on the main axle by side arms, through blocks which ride in segmental grooves, the front ends of these side arms being fulcrumed upon bell crank levers, connected to a cross shaft. The main axle also carries a gear, readily thrown into and out of engagement, which works a shaft carried by the side arms, with a bevel gear that operates a rearwardly extending horizontal shaft, carrying two screw flanges or spiral blades, to the edges of which the cage is secured, and other internal and smaller flanges which extend outward and at right angles from the larger flanges. To the lower forward end of the cage is connected a scoop, and the lower half of the cage at the rear is covered by a semicircular curtain connected to the main frame. The tongue is hinged to the first of two cross bars of a forwardly extending frame carried by the main axle, and is provided with a bracket through which there passes a crank shaft mounted upon a forward cross bar of this frame, an operating lever being connected to the shaft, and a rack arranged in connection therewith, whereby the tongue may be raised or lowered. Bell crank levers carried by the main shaft, and connected to the shaft which operates the cage with spiral blades, are connected by rods to the bell crank levers carried by a shaft on the forward end of the frame, and a vertical lever is rigidly connected to this shaft, by the moving of which backward or forward the scoop is raised or lowered, its proper inclination being given by raising or lowering the tongue. Steel clearers are arranged to bear against the edges of the spiral blades, to cut off weeds and tops. As the blades are revolved, the loose earth is sifted through the openings in the cage, and the potatoes, being held from falling backward by the internal outwardly extending flanges, are delivered over the rear cross bar to any proper receptacle connected to the back of the machine.

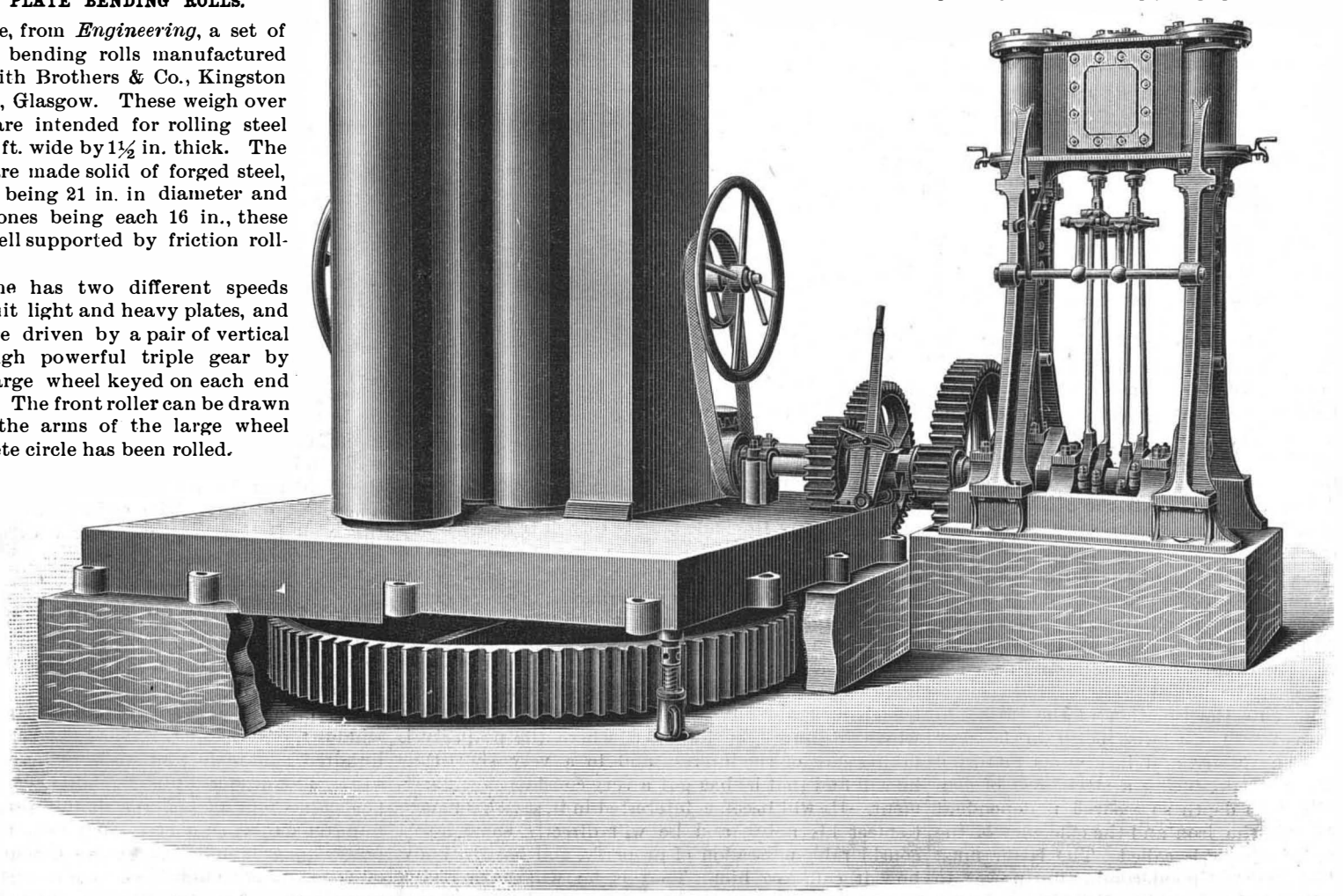


COLLINS' POTATO DIGGER.

VERTICAL PLATE BENDING ROLLS.

We illustrate, from *Engineering*, a set of vertical plate bending rolls manufactured by Messrs. Smith Brothers & Co., Kingston Engine Works, Glasgow. These weigh over 40 tons, and are intended for rolling steel plates cold, 11 ft. wide by 1½ in. thick. The three rollers are made solid of forged steel, the front one being 21 in. in diameter and the two back ones being each 16 in., these latter being well supported by friction rollers.

The machine has two different speeds of gear, to suit light and heavy plates, and the rollers are driven by a pair of vertical engines through powerful triple gear by means of a large wheel keyed on each end of the rollers. The front roller can be drawn up between the arms of the large wheel after a complete circle has been rolled.



IMPROVED VERTICAL PLATE BENDING ROLLERS.

Action of the Telephone.

The following is an abstract of a paper in the *Elektrotechnische Zeitschrift:* "The mechanical movement of the diaphragm of the telephone, if actuated by powerful currents, can be shown by the nodal lines formed by lycopodium dusted on its face; but if the current be generated by a microphone or by another telephone actuated by singing or speaking, not a trace of a Chladni's figure is produced. By affixing a small mirror, however, between the center and circumference of the diaphragm, and reflecting therefrom a beam of light on to a distant scale or telescope, its motion can be detected; but for a lecture demonstration the best method for exhibiting this motion is to fasten a stretched wire to a projection on the center of the diaphragm, and fix a mirror longitudinally on the wire between a loop and a node, by which means a movement of 18 in. or so can be given to the spot of light on the scale. The form of the vibration is, of course, not reproduced in this latter instance. If mirrors be fixed to both the actuating and receiving instruments, the beam, after reflection from both, being thrown on a screen, as in Lissajous' method, the figures observed afford a most simple means of illustrating the deformation of the musical notes or vocalization which results from the action of the diaphragm itself. For the most accurate examination of the movement of the telephonic diaphragm the author has adopted Konig's method of dancing flames analyzed by a rotating mirror; and outline diagrams of the different forms of the vowel sounds as sent and received, revealed by this method, are given. The effect of the introduction of electrical resistance, capacity or self-induction in the circuit, as regards the alteration and interconfusion of the different vowels or consonants, is thereby clearly revealed, and is due not so much to reduction of the intensity of the sound as to the rounding off of the current waves. The permanent record of these flames could not be photographically produced with ordinary gas; but a certain degree of success followed the use of bisulphide of carbon vapor burning in nitrous oxide gas, as by this means the maxima or ridges of the flames were clearly developed, though the minima or furrows were somewhat indistinct. The author proposes the application of this method for testing dynamo machines, as by it can be seen the actual progress of the phase in the alternating current, or the impulse at the passage of the brush over each commutator plate in the continuous current. It could also be conveniently applied for chronographic measurements, *e. g.*, the velocity of projectiles in the gun tube. Let the shot contain an iron bar, and the gun be surrounded by a series of coils which are in connection with a telephone and some source of electric current; then the time of the passage across the plane of each coil can be actually recorded on the photographic plate, the great advantage of this method lying in the fact that the gun tube need not be tampered with, and that one or two sets of coils would suffice for guns of any caliber."

Electro-plating with Aluminum.

Herman Reinbold, in the *Jewelers' Journal*, says: The solution of the plating bath is as follows: 50 parts of alum, $AlK(SO_4)_2 + 12H_2O$ are dissolved in 300 parts of water, and to this 10 parts of chloride of alumina (Al_2Cl_6) are added, heated to 200° and cooled, whereupon 39 parts of cyanide of potassium are added. The object to be plated has to be cleaned, and to be absolutely free from grease in any form, whereupon it is suspended in the bath over the electro-positive electrode, the plate of metallic aluminum to be suspended on the negative pole. The electric current ought to be weak.

The plating when polished will be found to be equal to the best silver plating, having the advantage of not being oxidized or getting black when brought into contact with sulphurous vapors, which would make it especially valuable for plating spoons and tableware.

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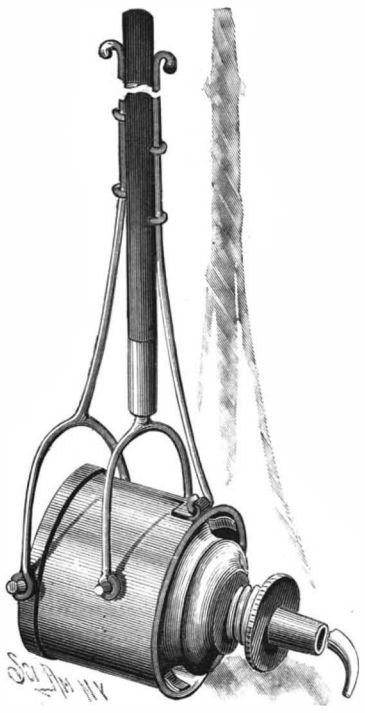
AN IMPROVED OIL CAN HOLDER.

A device to facilitate the lubricating of machinery, where the parts are not ordinarily within reach or easily accessible, is shown in the accompanying illustration, and has been patented by Mr. Edgar G. Bruner, of West Point, Neb. The device consists of a cup

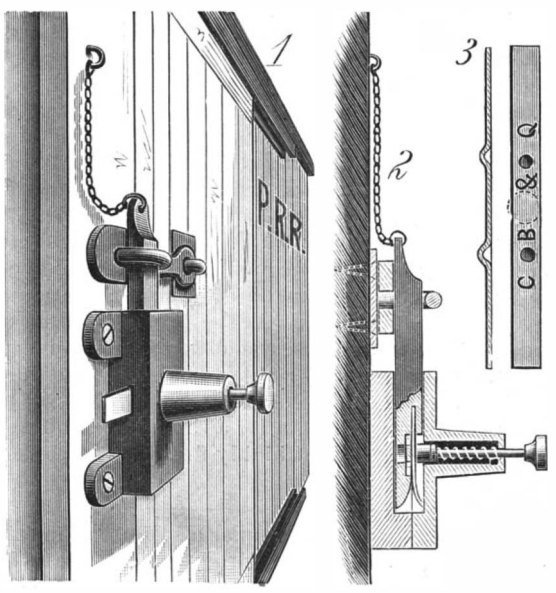


BRUNER'S OIL CAN HOLDER.

of suitable size and shape to hold an oil can, and provided with an elongated handle, and rods for holding and adjusting the cup in the desired position, the cup having retaining springs in its interior for holding the oil can in place when the cup is canted or even completely reversed. The handle is attached to the cup by a yoke, and a rod secured to the bottom of the cup affords bearings for another yoke secured to a slide bar which passes through staples in the handle. Another slide rod, passing through staples in the handle, is connected to the cup by an eye at the rear of its rim, and by the aid of these rods, which have free lateral play along the handle, the cup can readily be tilted and held in any position desired.

AN IMPROVED SEAL LOCK.

A seal lock which may be operated without the use of pinchers or pliers, adapted to receive a sealing strip, and especially designed for use on freight car doors, is shown in the accompanying illustrations, and has been patented by Frank W. Richey and Sumner M. Robbins, of Armstrong, Wyandotte County, Kansas. The end of the locking bolt which enters the lock case is provided with a spring tongue, the extreme end of which is bent outward, while the extreme end of the bolt proper, opposite the end of this spring tongue, is cut away, as shown in the sectional view, Fig. 2. Just back of this cut-away end of the bolt is a shoulder, so that there is a space behind this shoulder between the tongue and the bolt, in which the sealing strip rests, there being also an aperture in the spring tongue to register with another aperture in the recess in the bolt. A plunger



RICHEY AND ROBBINS' SEAL LOCK.

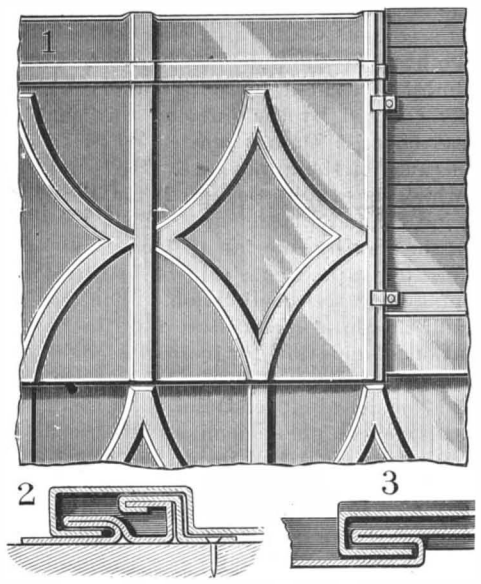
with a punch point is mounted in a housing that extends outwardly from the lock case, and is held in normal position by a spring coiled about the plunger stem. The seals consist of strips of metal in which are formed projections, as shown in Fig. 3, in side and front views. Before the insertion of the bolt, one of these sealing strips is passed through the lock case, and so adjusted that its projections will be upon either side of the bolt cavity. Then, as the bolt is forced inward, the plunger being held back, the sealing strip will be borne upon by either the out-turned edge of the spring tongue or by the cut-away end of the bolt, and will enter the space back of the shoulder in the bolt, when the plunger is permitted to enter and rest in the slot in the spring tongue, and the lock is sealed. The sealing strip cannot be drawn out of the lock case, owing to the formation of its projections on either side of the bolt, nor can the bolt be withdrawn, as its shoulder would strike against the sealing strip. To open the car door, a slight tap is made upon the outer end of the plunger, when its punch point is forced inward and severs the sealing strip, as indicated in dotted lines in Fig. 3, after which the ends of the severed strip may be removed from the lock case and the bolt withdrawn.

Wood Fibers Capable of Being Spun.

Boards as free from knots as possible, of any desired width, and about ⅜ of an inch thick, are cut in a direction parallel with the fiber, preferably from pine or fir wood or from the softer part of larch, and are boiled in a solution of sulphurous acid or a bisulphite, whereby the disintegration of the wood is effected. No chopping is required, and before boiling the wood is steamed at 212° Fah. for a long time. After boiling the mass is partly dried on a wooden frame and then passed through rollers having "deep ribs" in the direction of their length, the projections on one roller fitting in the corrugations of the other, whereby the fibers will be separated from each other, and may be combed in an apparatus similar to that for combing flax, etc.—*By Alex. Mitscherlich, Freiburg.*

AN IMPROVED METALLIC SHINGLE.

A metallic shingle which is easily applied to the roofs or sides of buildings, which is storm proof and cannot be easily stripped off by winds, while being inexpensive and durable, is shown in the accompanying illustration, and has been patented by Mr. Henry Smeeton,



SMEETON'S METALLIC SHINGLE.

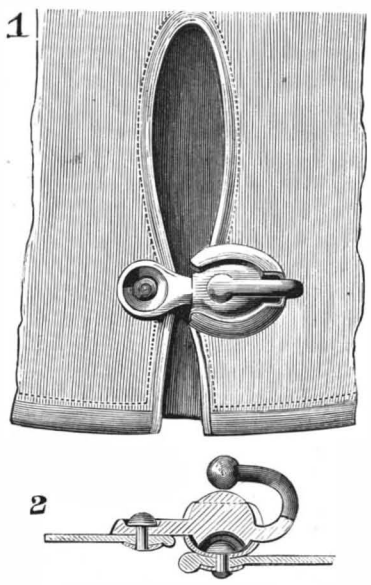
of Ottawa, Ill. It is made of a single piece of metal so bent and doubled at its edges as to form locking joints on all four of its sides, Figs. 2 and 3 showing sections of the vertical and horizontal joints. The faces of the shingles may be made flat or plain, although shown with a raised diamond-shaped design, and they may be trampled upon without injury or starting joints or seams, as they are not nailed through at the side edges, but held by clips, and will yield somewhat to expansion and contraction. In laying the first course on a roof, the center of the overlapped top portion of each shingle is secured to the roofing boards by a nail, and its right hand side by one or more clips, this side then affording a lip for hooking the left-hand side of the next shingle to it, and so on for the course, the first shingle at the left-hand side having been fastened at the edge in any proper way. Dependence may be placed entirely on the clips to hold the shingles to the roofing boards, but the use of clips at the sides and a nail on the top is preferred.

Keep the Traps Filled.

A medical correspondent, writing to the daily press, calls attention to the risks to householders resulting from the evaporation of water from traps, occurring during a period when the house is unoccupied, and states that it has fallen to his lot to see more than one outbreak of sore throat, which he believes is caused by this circumstance. It may be hoped that the usual house cleaning, which necessitates the occupation of the house immediately before the return of its owners, is for them a safeguard; but the subject is well worth the attention of householders, in the interest of caretakers as well as of themselves, and the careful charging of traps and the thorough ventilation of houses are necessary wherever they have been left uninhabited during any period of time.

AN IMPROVED GLOVE FASTENER.

A simple and efficient fastener for gloves, by which they may be easily and quickly fastened and unfastened, and which can be readily applied to the glove, is shown in the accompanying illustration, and has been patented by Mr. George Geary, of Johnstown, N. Y. A spring socket is attached to one side of the slit of the glove, and an arm attached to the glove at the opposite side of the slit is provided with a ball adapted to fit in the spring socket. The latter is a concave metal plate, with ears which are also concave and incline toward



GEARY'S GLOVE FASTENER.

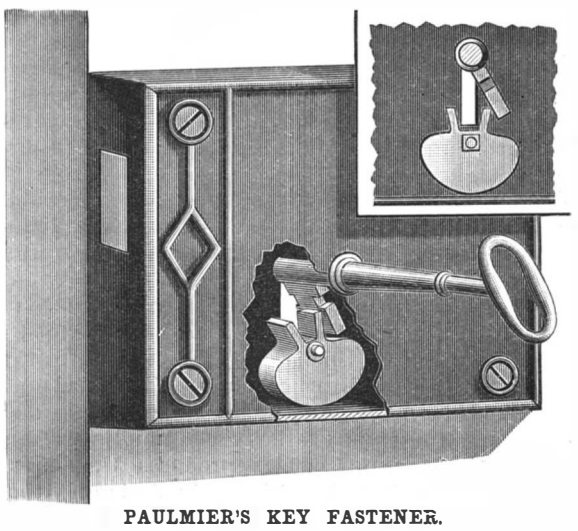
each other, there being a notch in the side adjoining the slit and another notch in the opposite side, together with a central hole by which the socket is secured to the glove by a rivet. The arm carrying the ball adapted to fit into the spring socket is turned over the top and made into a knob, for convenience in springing the ball into the socket and removing it in fastening and unfastening gloves.

Products from Essence of Birch Bark.

E. Mourlot, Paris, obtains from essence of birch bark, by rectification, an essential oil, which possesses among other properties that of being fatal to "insect life," and an electrically insulating tarry substance. These two products are so treated and combined with other substances as to produce an anti-oxidizing material and an insulating substance capable of the same applications as ebonite. Among the other ingredients employed, in addition to the products from the essence of birch bark, are caoutchouc, sulphur, chalk, talc, litharge, antimony sulphide, kaolin, zinc white, and red ocher.

A DEVICE TO RETAIN KEYS IN LOCKS.

A simple attachment within a lock case, which prevents the key, when left in the lock, from working or being thrown out, is shown in the accompanying illustration, and has been patented by Mr. Stephen H. Paulmier, of Madison, N. J. It consists of a movable guard, in the form of a pendent weight, pivoted within the lock case directly below the key hole, the guard having two upwardly extending arms or wings, between which the bit of the key passes when entering the lock. This guard, when the key is not in the lock, naturally adjusts itself, according to its center of gravity, so that the arms or wings will stand at either side of the keyhole, and the key is freely ad-



PAULMIER'S KEY FASTENER.

mitted; but when the key has been turned sufficiently to pass these wings, as in throwing the bolt, and is allowed to come to rest, the guards prevent it from turning down, so that its bit will lie in the line of the key hole, as frequently occurs in the shutting or slamming of doors, although it can be so turned by hand with perfect facility when desired. This guard can be readily attached to almost any lock, and does not necessitate any special construction of the key.

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The Millers' and Bakers' International Exhibition at Milan, Italy, 1887.

This exhibition was opened by the King of Italy, on May 19; its object being the improvement of corn grinding, bread making, and baking; and with some considerable amount of elasticity, the committee has confined the exhibits to such machinery and articles as may be in some way connected with one or other of these trades.

The milling industry in Italy employs about 170,000 horse power, of which only about 15,000 would be water power, and about 70,000 hands are engaged in it. Up to 1883 about 600 pairs of rolling cylinders were in use, but since then a great addition has been made to them. The small mills are gradually disappearing.

The exhibition occupies a space of about 26 acres, of which six are built over, the remainder being laid out in gardens. The exhibition is considered a financial success.

The total number of exhibitors is 386, of whom four-tenths are from abroad, principally from Germany; about 20 are from England, about 30 from Switzerland, and 15 from France.

The gallery of machinery in motion, in which mills, complete with all the necessary machinery for wheat cleaning and grinding on the gradual process system, are being exhibited at actual work, is interesting.

The wheat cleaning and flour dressing and elevating machinery are principally copies of English and American machines, but they are well made. Messrs. Ganz, from Budapest, who have a branch house in Milan, are large exhibitors of their roller mills, of which they informed me they had sold some 15,000 in all parts; about 800 only in Italy.

The motive power is supplied to the mills at work by two horizontal compound condensing engines of 100 horse power each, fitted with the automatic expansion and instantaneous cut-off valves.

There are four ovens kept in continuous work baking bread and biscuits; but the only one apparently using mechanical means in connection with the oven is by Signor Candelo, which has a revolving iron plate of about 10 feet diameter, turned by hand by means of gearing, the bread being placed upon this plate, and the heat communicated by flues to both above and below the plate; 4,500 pounds of bread can be baked in this oven in 24 hours, with a consumption of about 220 pounds of coal. The other ovens differ from each other simply in the manner of diffusing the heat.

The committee, with a view of making this department practically instructive, has arranged with the different benefit societies of bakers, in various parts of Italy, to send a certain number of selected workmen to visit the exhibition and make experiments extending over say a week; making bread, and using alternately the different systems of machines and ovens, so that on returning to their homes they can speak with authority as to the advantages of the mechanical over the hand process of making bread, which is still generally in use in Italy.

In the grounds of the exhibition there are several pavilions. One pavilion is devoted to rice cleaning machinery, exhibited by Signor Giuseppe Locarni, of Vercelli, who, by making this his specialty, has arrived at a certain perfection. The machinery is shown at work, and includes the whole process of cleaning, brightening, and pearling the rice.

There is a very interesting pavilion devoted to electric lighting machinery. There are 28 exhibitors in this class, of whom 14 are Italian, 6 English, 3 German, 3 Swiss, and 2 French.

Another pavilion contains the seven large boilers for supplying steam to the different engines. Five of these boilers were constructed in Italy, one is from England, and one from Germany. Forming part of this exhibition, but under the control of a committee appointed by the government, there is an annex of machines entered for the international prize competition of grain driers. The premiums offered by the government amount to £200 sterling for the machines that will most rapidly and economically dry Indian corn and rice, so as not to injure their food, storing, or seed properties.

Indian corn, when ground and converted into polento, forms the principal item of the laborer's food in North Italy, and as this is often harvested at a time of the year when dry weather cannot be depended upon, it is stored in a damp state, producing mouldy or damaged flour; and it is the large consumption of this among the peasants which produces the disease called "pellagra," and which nearly decimates them in North Italy.—*From Consul Whitmore's Report.*

THE *Blacksmith and Wheelwright* says that a very good way to anneal a small piece of tool steel is to heat it up in a forge as slowly as possible, and then take two fire boards and lay the hot steel between them and screw them up in a vise. As the steel is hot, it sinks into the pieces of wood and is firmly embedded in an almost air-tight charcoal bed, and when taken out cold will be found to be nice and soft. To repeat this will make it as soft as could be wished.

Detection of Counterfeits by Photography.

Photography has long been considered the faithful confederate and trusty ally of counterfeiters and forgers, but it cannot be looked upon in that light any longer, as M. Gobert, of the Banque de France, has succeeded in converting this art into a most efficient detective agent. His process consists of taking a greatly magnified photograph of the suspected coin or document, on which any erasure or defect can then easily be detected. An interesting example of the success which can be obtained in this way is given in *La Nature*, from which we abstract the following account: Some time ago a check for 1,106 francs, drawn in favor of a Mr. Rochu, was presented for payment at a Parisian bank, and was to all appearance perfectly genuine, the signature being undoubtedly correct, and no erasures or alterations in the amount could be detected. The suspicions of the bank manager were, however, aroused, and the check was forwarded to M. Gobert for examination, who made a photographic reproduction of it as explained above. It was then discovered that the check had originally been drawn in favor of a Mr. Suller, and for 110 francs, the name and amount being easily readable under the new writing. Probably equally good results could have been obtained by chemical means, but photography has the advantage of not injuring the fabric of the check. False coins are detected in much the same way, an enlarged photograph of both a genuine coin and the suspected one being made, and the two then compared.

Chemical Substitution.

Dumas, in 1834, by his law of substitution threw light upon a whole series of singular and unexplained phenomena by showing that an exchange can take place between the constituent atoms in a molecule. Laurent indeed went farther, and assumed that a chlorine atom, for example, took up the position vacated by an atom of hydrogen and played the part of its displaced rival, so that the chemical and physical properties of the substitution product were thought to remain substantially the same as those of the original body. A singular story is connected with this discovery. At a soiree in the Tuileries in the time of Charles X. the guests were almost suffocated by acrid vapors which were evidently emitted by the burning wax candles, and the great chemist Dumas was called in to examine into the cause of the annoyance. He found that the wax of which the candles were made had been bleached by chlorine, that a replacement of some of the hydrogen atoms of the wax by chlorine had occurred, and that the suffocating vapors consisted of hydrochloric acid given off during the combustion. The wax was as white and as odorless as before, and the fact of the substitution of chlorine for hydrogen could only be recognized when the candles were destroyed by burning. This incident induced Dumas to investigate more closely this class of phenomena, and the results of this investigation are embodied in his law of substitution.

The Landes and Dunes of Gascony.

When Major F. Bailey, R.E., last year visited Gascony for the purpose of examining the pines of the country, he also paid special attention to the construction of the works for their protection against the sand, which, unless proper precautions were taken to prevent its advance, would have overwhelmed them, and we again acknowledge our indebtedness to his able description of these.

The dunes are formed by the combined action of the mud and sea. Each ebb tide leaves a quantity of sand, a portion of which dries before it is covered by the next flow, and it is then liable to be blown away by the wind. Thus sand hills or dunes are formed, which rise sometimes to a height of from 200 to 250 feet, the line of their crests being generally perpendicular to the direction of the prevailing wind.

The sand hills themselves are kept moving slowly landward by the wind, which drives the upper layer of sand from the gently sloping outer face up to the summit, whence it falls down the steep slope on the landward side, and thus the dunes are rolled inland by slow degrees. The average annual rate of the advance of sand is said to be about fourteen feet per year.

As the source of the evil lies at the sea beach, and since, as regards the dunes already formed, the movement at any particular time is confined to the sand then at the surface, if this sand can be fixed during the time necessary to make a crop of herbs, shrubs, and young trees to be raised upon it, the movement of the entire mass will have been arrested.

The works for this purpose are commenced as follows: At a distance of about 165 yards from high water mark, a wattled fence forty inches high is erected. This seems to arrest the sand which is heaped up on the seaward side, a portion of it filtering through the wattles. After a time the fence is overtopped, and the sand, blown up the outer fence, forms a steep slope on the other side. A second wattled fence is then erected about 6½ feet behind the first, and the space between the two becoming filled up, and a mound rising over it, the sand which falls over stands at a high angle against the reverse side of the second wattle.

In the center of the mound a palisade of plank, forty inches above and twenty inches below ground, is erected, these planks, which are seven and eight inches wide and 115 inches thick, being placed three-quarters of an inch apart. When the sand drifts up against them, a portion falls through at intervals, thus affording support on the other side, and when they have become nearly covered, they are raised about two feet out of the ground by means of a hand lever and chains. This is repeated from time to time until the carrier has attained a height of about twenty-five feet, when a third wattle fence is constructed, at a distance of from five to six and a half feet behind the inner slope, and the top of the barrier is strengthened by means of a line of small fagots, which are half buried vertically in the sand. The fagots, each of which weighs about forty-five pounds, are placed at distances of four and a half feet from center to center.

During the time that elapses before the last fence is overtopped the palisade is not raised, so that the width of the base is increased and the top becomes broader and rounded. When the palisade, which is now moved back a short distance, is overtopped, it is raised as before, an additional wattle being placed in the rear of the work; and the building up of the mound by the action of the wind is continued in this manner until it has attained its maximum height of from forty to forty-five feet, when its breadth is allowed to increase, until it stands on a base about 330 feet broad. The foot of the outer slope is then about 100 feet distant from high water mark, the top being at least 165 feet broad and the slopes standing at thirty-five or forty degrees.

This result is usually attained in from fifteen to eighteen years. The surface of the mound is consolidated by faggots twelve to fourteen inches in circumference and fourteen to sixteen inches apart, buried vertically to a depth of sixteen inches in the sand and projecting eight to sixteen inches above the ground. It is also sown with *gourbet* (*Arundo arenaria*), about thirteen pounds of seed being used to the acre.

An artificial dune, constructed in the manner above described, now extends along the coast for a distance of 125 miles, from the Gironde to the Adour.

As soon as the further importation of sand over the country has been arrested by the palisade, a mixture, consisting of eleven pounds of pine seed, seven pounds of broom seed, and five pounds of gourbet per acre, is then sown on it broadcast, a palisade being erected at its inner limits, so as to prevent the seed from becoming buried under sand carried over it by land breezes. This structure is moved back as the work progresses, so as to serve for the protection of other belts. The seeds are covered with branches and brushwood, laid like tiles, with their butt ends toward the sea, and kept down by means of sand thrown upon them. The cost of the entire work is said to be about forty dollars per acre.—*Lumber Trade Jour.*

Wrought Iron Chains without Welds.

Rolling out iron chains from the solid bar without welding is one of the recent mechanical operations that have attracted attention. The principle of forming the rollers and the process of rolling out a chain is similar in some respects to the method employed in casting the links and having them come out together in a chain from a mould. In the latter operation the flask is made to part equally in four ways, and the chain moulded while the links are separated so as to divide the spaces equally between them, giving as little clearance as possible, which will not change their appearance perceptibly. The flask is divided, the chain removed, and one is cast in the mould. Similarly, a piece of chain is swedged out of a bar of iron in an analogous manner by means of four converging dies. To produce a continuous chain in this way the dies are made continuous by having them formed on the circumference of four rollers, arranged with the dies distributed in equal divisions, and the rollers driven by gear wheels, so that the four parts of a link will meet accurately in place. Proper clearance is given to the dies, so as to allow the material to leave the matrix freely as the roll revolves. As the blank is carried forward between the rollers, the dies partially press or swedge out the links at right angles to each other, breaking the fin or feather edge that is left on the inside of the links, which, after a thorough shuffling in a tumble barrel, come out highly finished and polished for the market.

COFFEE acts upon the brain as a stimulant, inciting it to increased activity and producing sleeplessness; hence it is of great value as an antidote to narcotic poisons. It is also supposed to prevent too rapid waste in the tissues of the body, and in that way enables it to support life on less food. These effects are due to the volatile oil and also to a peculiar crystallizable nitrogenous principle, termed caffeine. The leaves of the plant likewise contain the same principle, and the inhabitants of the island of Sumatra prefer an infusion of the leaves to that of the berries. Its essential qualities are also greatly changed, the heat causing the development of the volatile oil and peculiar acid which gives aroma and flavor.

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Correspondence.

The Chicago 18½ Inch Telescope—A Correction in Obituary of Alvan Clark.

To the Editor of the Scientific American:

My attention has just been called to your article on "Alvan Clark" in the SCIENTIFIC AMERICAN of Sept. 3. The 18½ in. telescope lens finished by Mr. Clark in 1862 was for the University of Mississippi, instead of the University of Michigan. The order was given by my predecessor, Dr. F. A. P. Barnard. The completed instrument was sold to the Astronomical Society of Chicago, as Mr. Clark had undertaken the work entirely at his own risk, and the war rendered its acceptance impracticable.

Our pier and dome built for this equatorial are still extant.

R. B. FULTON,
Prof. of Physics and Astronomy.
University of Mississippi, Miss.

The First Railroad in America.

To the Editor of the Scientific American:

In your issue Aug. 20 last, you state that the first American railroad was built in 1825–26, and was used for the purpose of transporting granite from the quarries near Quincy, Mass., to tide water. Will you allow me to claim for my father, George Magers, a Marylander, the honor of designing and directing the construction of the first railroad built in this country, between the years 1814 and 1816, at Falling Waters, near the town of Manchester, in Chesterfield County, Va., on the south side of the James River and a few miles from the city of Richmond? This I believe antedates the building of the Quincy road nine or ten years. He was engaged at the time in superintending a powder manufactory located at Falling Waters, and partially supplying the government's demand for powder during the war of 1812 with England. The road was built for the purpose of conveying the powder from the mill to a magazine located a couple of miles distant, in order to secure greater safety, and to prevent large destruction in case of fire or explosion. It was regularly operated by means of horse power through a number of years and until my father's death, which occurred in 1818. There is still living, in Baltimore, a gentleman of advanced life, Prof. George Elliott, of ballooning fame, who lived with his father at the seat of the mill, and who frequently rode in the carriages used upon the railway, and can verify the truth of the foregoing statement.

G. W. MAGERS.

Baltimore, September 12, 1887.

Adhesive Gum for Labels, etc.

The following mixture is stated by M. Eliel (*Revue Photog.*) to form a strongly adhesive gum, which will really make paper or parchment paper *stick* to any surfaces on which it may be applied, such as wood, glass, stone, or metal of any kind. It is therefore admirably adapted for use in the pharmaceutical laboratory, and indeed, with certain modifications introduced by ourselves, will be welcome among merchants and manufacturers generally. It is made thus:

Gum acacia	120 grammes or parts.
" tragacanth	30 " " "
Glycerine	120 cubic centimeters or parts.
Thymol	2·5 grammes or parts.
Water	q. s. to make 1 liter or 1,000 parts.

Soak the gums separately in a little water, and when the tragacanth is fully swelled, beat it up to the consistence of a thick homogeneous mucilage, and mix this with that of the gum acacia, and pass the whole through a piece of fine linen or "tammy." Add to this the glycerine, in which the thymol has previously been shaken up, and lastly make the whole up to a thousand parts, or one liter by measure, and store in suitable well-corked bottles ready for use.

For the 2½ grammes of thymol we ourselves prefer to substitute 2 grammes of eucalyptol or about 3¼ grammes or parts of Australian eucalyptus oil. With this gum labels or circulars can be made to adhere firmly to tins or metallic drums, etc., and if written or printed with the boracic "label ink," and afterward washed over with "water varnish," such labels, etc., will be very durable, and will remain unaffected by ordinary chemical solutions or dilute acids.

Weeds.

"Weeds," says a writer in *Social Science*, "are plants in the wrong place. They all probably have their right places and their uses somewhere in nature's economy, though these are sometimes hard to appreciate. The most of them may serve to keep some desolate spot from being entirely bare, and the decay of their repeated generations furnishes mould to the ground, and may in time make it fit to bear something better. They all, too, have elements of beauty, and these will reveal themselves to every one who diligently searches for them. Even the most forbidding are revealed under microscopic inspection as objects of rare beauty. Many of them, if they were not weeds, would be prized as choice flowers, and some of them have been such."

Artificial Rubies.

M. Fremy has returned to his old experiments on the manufacture of rubies. It will be remembered, says *Engineering*, that a few years ago he succeeded in forming small ruby crystals by a chemical or physical process in his laboratory. These crystals were too tiny to seriously compete with the natural stone. He now claims, however, to produce ruby crystals of excellent quality and larger size than the natural stones in use. This result has been obtained by a new process. The older processes of 1877, employed by M. Fremy and M. Feil, consisted in heating to a white heat in an earthen crucible a mixture of aluminum and minium. The red coloration was produced by bichromate of potash. The operation was often made with 20 to 30 kilogrammes of mixture, and gave several kilogrammes of rubies.

Another method was to heat to a high temperature a mixture in equal parts of aluminum and fluoride of barium with traces of bichromate of potash. The crystals thus obtained were remarkable for their neat form, but they were apt to be lamellar. In his recent experiments M. Fremy had the assistance of a talented young chemist, M. Verneuil, attached to his laboratory at the museum. Their first work was to find whether the earthenware crucible of the early experiments influenced the reactions, and they found it did not. Next they found that almost all the fluorides when mixed with alumina produced corundum by calcination at white heat. Fluoride of barium, fluoride of calcium, and cryolite were used by them. Crucibles of platinum were also employed. In the course of the experiments they found that a fluoride, such as fluoride of calcium, exercises on alumina an enormous power of mineralization. Thus they could crystallize all the alumina contained in a mixture of 1 part of fluoride of calcium and 12 parts of alumina. In order to investigate this fact further, they placed at the bottom of the platinum crucible some natural fluoride of calcium, white and transparent, and of great purity. It was covered carefully by a plate of platinum perforated with very fine holes. On the plate was put a layer of alumina obtained by calcination of pure ammoniacal alum. Thus charged, the crucible was heated for several hours at red heat in an earthenware crucible, and it was found that the fluoride of calcium had almost completely transformed the alumina into crystals of ruby remarkable for their neat form and their rose color. Thus alumina without being in contact with fluoride of calcium, and simply affected by the emanations of the fluoride, calcined in the air, is mineralized, losing its amorphous state and changing into a crystalline mass. This discovery is important in the science of mineralogy. It shows how such bodies as the fluorides, heated in contact with moist air, produce emanations which can crystallize amorphous bodies such as aluminum. Hydrofluoric acid, acting in a very high temperature, may play a considerable *role* in the reaction.

Effects of Lightning on Railway Signals.

The effect of lightning on electrical apparatus of all sorts is a subject on which accurate data seem rather scarce, and its effect on railroad signals especially is a point on which more light is needed. A cardinal principle in signals which are in any degree automatic is that they shall show danger in the event of any derangement, and numberless ingenious devices have been invented to provide against the possibility of a signal standing at safety when it has not been intelligently put in that position; but lightning is such a lawless element and may influence electrical apparatus in so many different ways that the counteracting of the harm it may do is not an easy task. It may make a ground connection, and thus allow a circuit to appear all right when it is not, being closed at one end and open (without battery) at the other. It may melt fixtures so as to permanently hold a signal in the position it is in at the moment; and again it may charge a wire with a current that will actuate the electro-magnets and work the signals when the signal man has taken no action whatever. While the chances of a signal being held any length of time in the safety position from the effects of lightning alone are very small, and while it is probable that nearly or quite all danger in this respect can be guarded against by cautionary instructions to the attendants, it is nevertheless well to make note of all peculiarities noticed, that experience may be compared. In a recent thunder storm at Palmer, Mass., the electric locks on the interlocking machine at the crossing of the Boston & Albany and New London Northern were alternately locked and unlocked several times by atmospheric electricity in the rails at and near the crossing. The storm also showed one of the disadvantages of underground wires. A lightning shock generally runs along a wire until it encounters more than ordinary resistance and then melts the conductor. An underground wire is more likely to have unequally corroded sections than an aerial one, and so furnishes first-class opportunities for the lightning to fuse and part it, where, in the case of a wire hung in the air, the resistance and damage would more likely occur in the office connections or apparatus. As is well known, the electric locks of the Union Signal Company's interlocking machines are so arranged that the circuit, through the rails, when closed, holds the armature away from its slot, and thus leaves the lever unlocked, so that any breaking of a connection by lightning or otherwise will lock the lever; which is in the direction of safety. But anything which should connect the two parts of the circuit so as to leave it normal with the rails excluded would leave the levers permanently unlocked.—*Railroad Gazette.*

The Fur-Bearing Animals in Central Park.

The *Fur Trade Review*, of this city, in an article on the fur-bearing animals at the menagerie in our Central Park, laments that so few species are represented, and that better specimens of the few kinds are not procured. It is not creditable to the city of New York, which the editor claims is the headquarters of the American fur trade in the United States. He believes, also, the members of the fur trade are sufficiently public-spirited to accomplish the object, if they will, and suggests that they make an earnest effort to remedy the defect, by securing domestic fur-bearing animals from all sections of the country for presentation to the Park authorities. He claims there need be no very great expense attached to such an enterprise. If the leading fur dealers will request collectors, trappers, and other out of town acquaintances, in a position to comply, to forward such animals as they may secure, there would, he thinks, be a generous and a general response.

The editor of the *Review* suggests the appointment of Mr. Jules Weil, of 123 Mercer Street, a committee of one to receive and duly present to the Central Park all animals received, in the name of the fur trade of New York or the United States, and it is hoped a ready response may be had to the appeal.

The Cascade Switchback Railway.

The completion of the main line of the Northern Pacific Railroad by the switchback over the Cascades is said to be the most marvelous piece of railroad engineering in the country. Its extent is but thirteen miles, and the cost $350,000. The cost of the Cascade division of the Northern Pacific will reach $8,000,000. The maximum grade on the "switchback" is two hundred and ninety-six feet to the mile. Two decapod engines, weighing one hundred and twenty-five tons each, are used on each train, one on each end of six cars. One of these is ample to draw the train, but two are used for fear of an accident by the uncoupling of the train or otherwise. It has been said that it is impracticable for the Northern to operate a freight traffic over the "switchback," but this is not true, and it has been so proved by a practical test. It is estimated that from thirty-five to fifty freight cars can be handled each way over the "switchback" in twenty-four hours. At this rate, each car holding ten tons, from three hundred and fifty thousand to five hundred thousand bushels of wheat can be sent to the Sound ports in twenty-four hours. There will be no trouble about the Northern Pacific not handling all the freight it can receive. Its management is too far-seeing to cripple its business by a short-sighted policy and deficient modes of transportation. The Stampede tunnel will be finished within eleven months by Nelson Bennett, the widely known contractor.—*Tacoma (W. T.) Ledger.*

Speed of Cutters.

The *Iron Industry Gazette* gives the following concerning the average speed of cutters on soft cast iron surfaces, making allowance for changes in condition and character of work: "In order to calculate accurately for milling work, the speed of cutter and amount of feed per revolution must be observed; that known, the computation is as follows: Multiply the number of revolutions of cutter a minute by the length of feed of one revolution, and the product is inches a minute that can be milled. Allowing about 40 feet a minute for surface speed of cutter, a ½ inch cutter should run at 300 revolutions a minute, with a speed $\frac{1}{150}$ inch to a revolution, giving a result of 2 inches of light milling a minute. A 1 inch cutter would make 150 revolutions a minute, with a feed of $\frac{1}{150}$ inch on a moderately heavy cut, allowing 1½ inch of milling a minute. A 3 inch cutter would run fifty revolutions a minute, with a feed of $\frac{1}{50}$ inch on heavy work, giving a result of 1 inch of milling a minute. The above are examples selected from observed results in practical shop usage."

Salt and Gas in Kansas.

At Ellsworth, Ellsworth County, Kansas, as a matter purely of speculation, some persons recently made up a fund to drill the earth to see what they could find. They were told by individuals learned in the geology of the region that the work would be fruitless, and advised not to waste the money, as there were no favorable indications. But the speculators went ahead with the drilling, and at a depth of 740 feet they struck a bed of pure salt, 160 feet thick, after which shale was encountered for 200 feet, and then, at a depth of 1,100 feet, a vein of natural gas was struck which promises to yield fuel in unknown quantities.

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PRACTICAL TRIAL OF THE PNEUMATIC DYNAMITE GUN.

On Tuesday, Sept. 20, the pneumatic dynamite torpedo gun was tried in practical work. The object of the trial was to show the United States naval authorities decisively the powers of the new weapon. The Secretary of the Navy had placed at the disposal of the company the old coast survey schooner Silliman. The proposed programme was the destruction of this vessel by two or three projectiles.

The eight inch gun already described and illustrated in this paper* was used in these trials. It occupied its old position, on the south of Fort Lafayette, its muzzle pointing toward Norton's Point, the extremity of Coney Island. Gravesend Bay lies between these two places. Two thousand yards from the fort the schooner was anchored, being moored head and stern, so as to float with her stern pointing directly toward the firing point. Her two lower masts and bowsprit were left in place with some of the standing rigging. Otherwise she was pretty thoroughly dismantled.

A number of steamers carried spectators. The Dispatch, U. S. N., with Secretary Whitney and members of the Advisory Board, went to a point about half a mile from the mark and anchored. The revenue cutter Grant, police boat Patrol, navy yard launch, several private yachts and small launches were present, the whole forming quite a fleet. Lieutenant E. L. Zalinski had charge of the piece.

Two range shots were first fired with blank shells. They descended quite near the mark. Next the gun was loaded with a charged shell, containing 55 lb. of explosive gelatine. Before each shot flag signals were exchanged with observers on shore, who triangulated the range. By watching these flags the spectators on the steamers could tell when to look out for the shot. As each discharge took place there was a report much like that of a cannon, followed by a very peculiar whistling sound as the shell passed through its trajectory.

The design of Lieut. Zalinski with the third shell was to injure the schooner, but not to destroy her. This work he reserved for two succeeding shots. When the third one was discharged, it came whistling ominously through the air and fell into the water a short distance astern of the schooner, descended a few feet, and exploded. It threw up a superb fountain of water, two or three hundred feet high, masking the after part of the vessel, and when the water fell back the schooner's mainmast was gone. The head was left swinging at the end of a stay attached to the foremast head, which was broken and sprung backward.

The schooner was boarded by the crews of two launches, and found to be badly injured. Her stern was severely shaken and she was leaking, so that the shot, though it had not touched her, had done much damage. This proved one of the claims of the advocates of the gun, that a shell falling near a vessel will do effectual work.

After the two launches had taken their crews on board and steamed away a fourth shot, also a 55 lb. shell, was fired. The third shell had fallen directly in the line of the two masts, and was a perfect line shot. One of the effects of the explosion had been to slew the stern of the schooner around so that she had her after quarter toward the gun. Under these circumstances, when the fourth shell was discharged, it fell very near the hull and penetrated the water until it was directly beneath her, as nearly as possible under the steps of the mainmast, when it exploded. The column of spray that it threw up was greater than before, owing to the overlying vessel. It completely hid the after part, and when it descended the schooner was blown to pieces. Her fragments settled back into their old place, nearly level with the surface of the water. Above the wreckage the step of her mainmast and her iron water tank could be seen. Everything else was nearly level with the water. The foremast still stood over the sunken bow. An instantaneous photograph taken just as the explosion was felt by the vessel shows the hull lifted up a few feet above its normal position, and the spray and water rising in the air. The view is of interest as illustrating this lifting action.

Thus the target was destroyed in two shots with a total amount of a little over one hundred pounds of gelatine. It showed what terrific power would be possessed by the six hundred pound shells which the new cruiser will be able to discharge.

* See SCIENTIFIC AMERICAN, Vol. 53, No. 18, Vol. 56, Nos. 9 and 15, and SUPPLEMENT, No. 593.

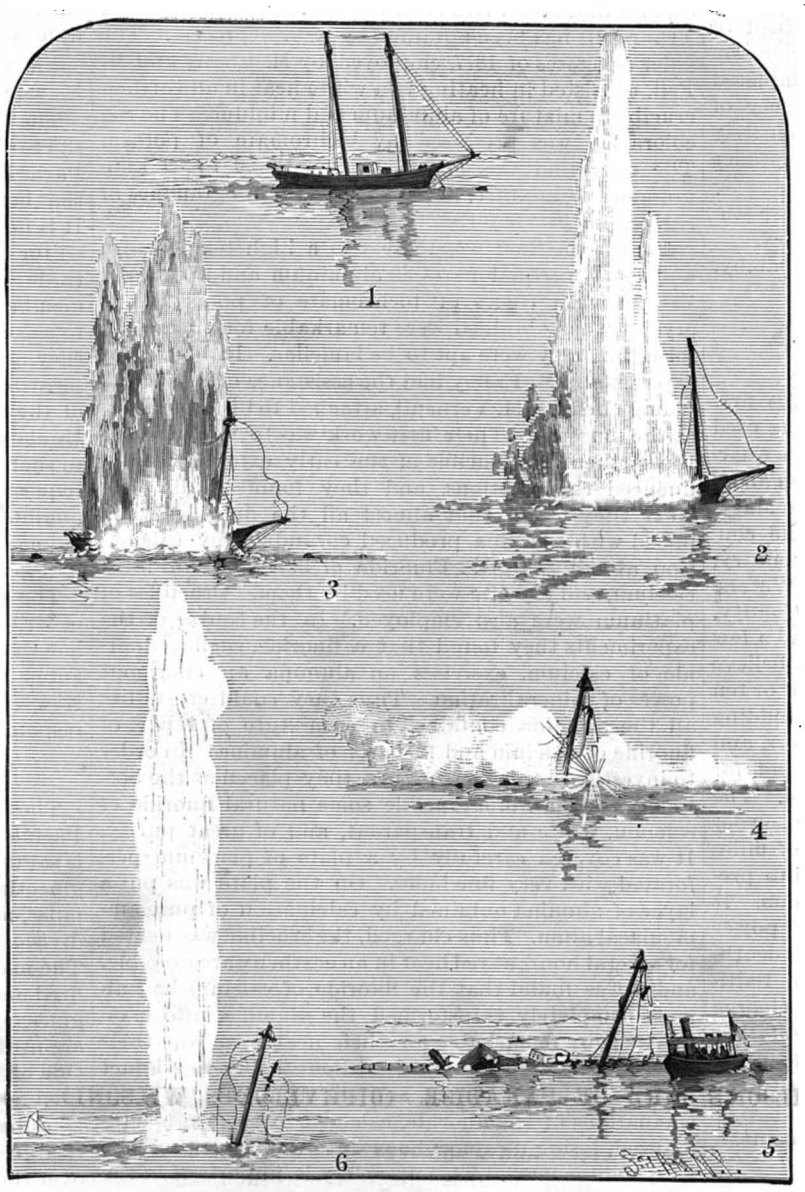
The foremast was still standing, and some dismantled rigging swung from its top. A fifth shell was now fired. This contained the same weight of gelatine, and ranged rather high. Its percussion fuse probably struck some of the floating wreck, for when directly over the vessel, almost level with the water, it exploded with a bright flash of flame. This shot illustrated what would be an effective method of attack in some cases. An aerial explosion of several hundred pounds of gelatine directly over the deck of a vessel would probably render most of her crew *hors de combat*. The experiment of course is an untried one as regards its effects upon life, but it seems probable that much injury might be done in this way.

Finally a one hundred pound shell was fired at the wreck. This also went rather too far, but exploded about ten feet under water very near the vessel. Had she been afloat and not level with the water, it would probably have struck her and done as great damage as the first.

This concluded the exhibition and demonstrated conclusively the powers for destruction of the weapon. The new cruiser that is to carry several of these guns will be an interesting subject of trial. The design is to have her carry the guns in her hold. They will be of constant elevation, and the trajectory will be varied by regulating the quantity of air admitted. The pointing and aiming will be executed by maneuvering the vessel.

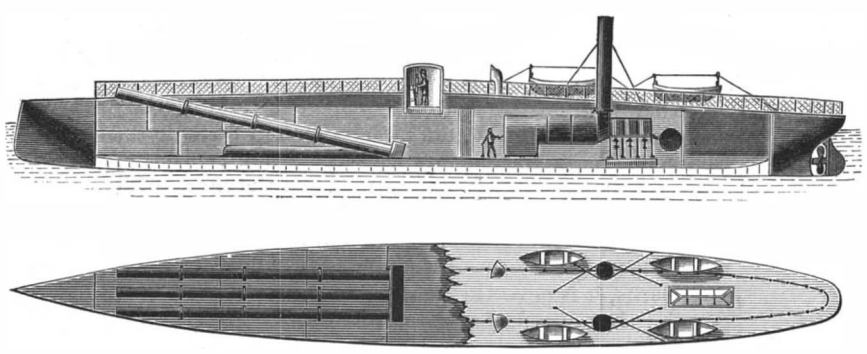
Several points of interest are brought out by the new piece. The high trajectory that is often objected to has its good feature in a ship, as the range will be less disturbed by pitching under the action of the waves. A practice resembling mortar practice may be tried, it has been suggested, in dropping shells upon a vessel's deck. Two or three falling on a ship would doubtless work their way through her bottom. The sound made by the shell as it passes through the air is followed by the explosion. To an observer half a mile off the latter is seen before it is heard, and while the whistling of the shell is still audible. Thus, when the shell has exploded, the ear still places it in the air and hears the whistling produced some seconds before. The shell after it has exploded seems still to be on its journey, until finally the noise of the explosion is heard. Some of the observers could see it, but exceedingly good eyes were requisite for this, as the steamers were situated.

The initial velocity of the projectile is considerably more than 600 feet per second, or about one-third that of the shells of heavy ordnance. It should be compared, in justice, not with guns, but with torpedoes. Yet by its remarkable accuracy at a mile range it showed that it is comparable with cannon. In actual war the latter, where exact firing is necessary, are used at ranges well within the reach of the pneumatic gun. The power to accurately place a torpedo charged with a high explosive within a range of two miles will be a factor of great account in future wars of offense and defense. A table of the data of this gun has already been published in the paper already alluded to, and may be consulted with interest after this practical demonstration. It may be mentioned here that although an hour was occupied in the last trials, yet four shots have been fired by Lieut. Zalinski inside of ten minutes without any effort at hurrying and without skilled men.



EPISODES OF THE TRIAL.

1. The Silliman before the trial. 2. The first explosion. 3. The second explosion. 4. The third explosion in the air. 5. The wreck of the Silliman after the second shot. 6. The fourth explosion.



PLAN AND SECTION OF THE DYNAMITE CRUISER.

Inventive Genius Developing in Streaks.

One of the leading authors of the present day has remarked that "genius comes in shoals." There is a depth of truth in the remark, says a contemporary, which must at once be patent to all who are familiar with the history of our country, and in no field of inquiry does the fact stand out so prominently as in the great outbreak of inventive genius by which our country is distinguished. The Elizabethan age was characterized by a shoal of dramatists, next we have a shoal of essayists with the amiable Addison at their head, and down through the years until what Carlyle has called "the mechanical age" set in. The birthday of the manufacturing supremacy of England was undoubtedly the 5th of January, 1769, when James Watt announced his patent "for a method of lessening the consumption of steam and fuel in fire engines." This was the source and sustaining power of mechanical energy whose action quickly changed the face of the world.

The inventive minds fulled in a shoal, and before half a century elapsed England was in possession of the most perfect mechanical appliances. Since the commencement of the "mechanical age" the aspect of the country has been entirely changed. In districts like the "Black Country," where nothing formerly appeared but rural scenery, great manufacturing establishments have been erected, towns raised, and the roar of furnaces, the noise of machinery, the buzz of reels, and ceaseless activity now diversify the scene where nothing was formerly heard but the purling steam or the howling of the tempest. Not only do the inventive minds come in shoals, but shoals of inventors who concentrate their united energy on some special branch of mechanics or science are every now and then springing up, and invention follows invention with surprising rapidity. These inventions are always shifting; at one time there is a run for improved furnaces, at another improved modes of constructing ships; then comes a change to machinery, or some matter of great public interest, like the rivalry in the improving of the different systems of electric lighting. Not only do inventions shift from one branch of science and mechanics to another, but at times a lull comes over one country, and a great outbreak of inventive genius breaks out in another country.

Care of Carriages.

A dry house, free from dust and the sun, and away from the stables, is of first importance. If you keep your buggy near the stables, the ammonia will kill the varnish in a very short time.

Never, under any circumstances, rub oil over your carriage to brighten it up. It is sure to ruin the paint. Use a good sponge and a clean chamois, with plenty of clear, cold water to wash the mud off with. Never use a duster or broom on varnished work. Never allow water to be thrown inside the body. It is sure to affect the glue and swell the timbers, so as to break the joints. Mud allowed to dry on a carriage is of no benefit. Frequent oiling of axles does no harm.

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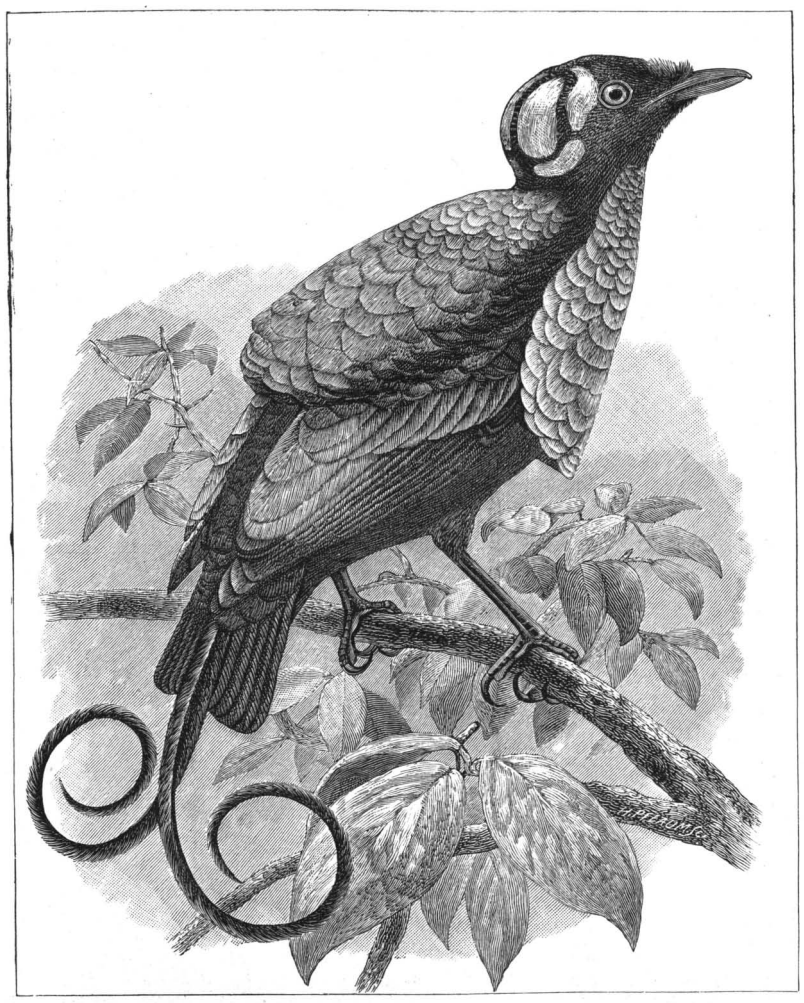
BIRDS OF PARADISE.

Dr. F. H. H. Guillemard, in his interesting natural history work entitled "The Cruise of the Marchesa," gives the following account of some of these birds which he obtained in New Guinea:

Our first ramble on shore was attended with but little success. We searched in vain in one of the lesser bays for a patch of beach on which to disembark, but the mangroves, which in these regions obliterate utterly all boundary between sea and land, met us at every turn, and ultimately scrambling over their slimy roots, and struggling up to our knees in liquid ooze, we had to reach *terra firma* as best we could. The land rose steeply from the sea, and the jungle, dripping wet from the heavy rain which we had almost constantly experienced since our arrival in New Guinea, rendered our progress anything but comfortable. Forest rambles such as these, it must be confessed, are somewhat trying to the temper. Wet through with perspiration, each yard makes the already streaming traveler, if possible, still wetter, for every leaf encountered pours a little bucket of water upon him as he struggles through the mass of creepers that bar his path. Shooting and walking cannot be combined under such conditions, and almost the only method for the naturalist to obtain specimens is to post himself under some tree in fruit, and to wait patiently until the birds that are feeding upon its summit happen to come within range of his gun.

We returned rather disappointed to the yacht, and found that some of the hunters had already got back. They had shot nothing of any particular interest. Presently, however, Usman and his *compagnon de chasse* appeared, triumphant, carefully carrying a prize that we had hoped but hardly expected to obtain—the curious and exquisitely lovely little *Diphyllodes wilsoni*, smallest of all the birds of paradise. Behind the head a ruff of canary colored feathers stands erect above the scarlet back and wings. The breast is covered by a shield of glossy green plumes, which toward the throat are marked with metallic green and violet spots of extraordinary brilliancy. The two center feathers of the tail, prolonged for five or six inches beyond the others, cross one another, and are curved into a complete circle of bright steely purple. But the chief peculiarity of the bird is in the head, which is bald from the vertex backward, the bare skin being of the brightest imaginable cobalt blue. The *bizarre* effect thus produced is still further heightened by two fine lines of feathers which, running lengthways and from side to side, form a dark cross upon the brilliant azure background. I could hardly make up my mind to skin this little ornithological rainbow, whose exquisite plumage it seemed almost a sacrilege to disarrange, but the climate of New Guinea allows of but little delay in this operation, and I set about my task at once. The bird had been scarcely injured by the shot, and I succeeded in making a perfect skin of it. We also added a hen bird of the same species to our collection. Its plumage is of a sober brown, as is the case with the females of all the Paradiseidæ, but, like the male, the bare head is blue, although not nearly of so bright a color.

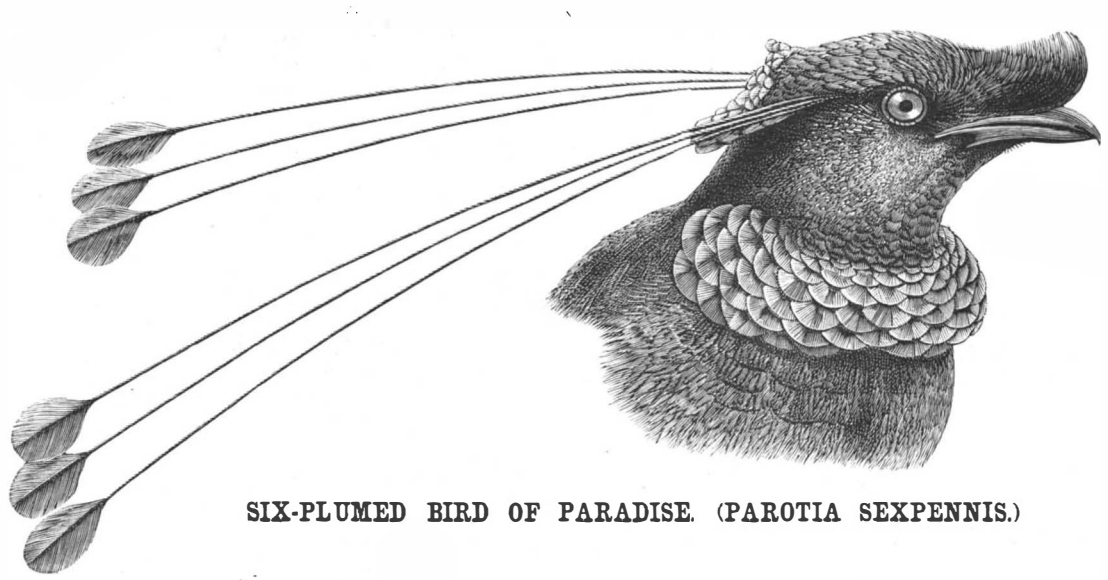


WILSON'S BIRD OF PARADISE. (DIPHYLLODES WILSONI.)

Wilson's bird of paradise, which we had thus been the first Englishmen to obtain, the naturalists Beccari and Bernstein being the only others who have been fortunate enough to meet with it in its native haunts, is entirely confined to Batanta and Waigiou Islands; but though we afterward shot it in the latter, it would seem to be much rarer there, and during Mr. Wallace's two months' visit he failed to obtain it. We found it frequenting trees of no great height at an altitude of seven or eight hundred feet above the sea, and there is no doubt that, like many of the family to which it belongs, it is very local in its distribution. This localization is not necessarily permanent, but seems to be dependent rather on the abundance in certain spots of the fruit in season, for most of the birds of paradise are in the main frugivorous, although occasionally varying their diet with insects.

The paradise birds attract attention less by the brilliancy than by the extraordinary development of their plumes. From the Arfak range we had obtained several species, which at a little distance look a uniform black. Two of these—*Lophorhina* and *Parotia*—are furnished with appendages which are, perhaps, as striking as any with which long ages of sexual selection have provided the birds of this group, but until the specimen is taken up in the hand they will pass unnoticed. In the former* an immense plume of feathers springs from the occipital region, and reaches to the end of the tail. It is of the deepest velvety black, shot in some lights with oily-green reflections, and with the outermost feathers slightly recurved toward the tip. The top of the head is covered with scale-like feathers of metallic green, and a shield of the same color and nature, but of a still brighter shade, adorns the breast. The rest of the body is dull black. Any further ornament or color would be out of place, and one feels that the superb creature fully deserves its appellation of the superb bird of paradise.

Almost more beautiful still is *Parotia sexpennis*, the six-shafted bird of paradise, which Signor D'Albertis was the first European to observe in its native jungle. The curious plumes which give the bird its specific name lie so close to the neck in the dried skin as to be almost invisible. They consist of three slender filaments springing from each side of the head and terminated by a spatulate expansion. A bar of vivid steely green across the vertex, and a peculiar puff of metallic silver at the base of the beak—a color, which, so far as I know, is unique in the bird world—completes the head decoration. Like *Lophorhina*, the rest of the plumage is almost entirely black, except at the upper part of the breast, which is furnished with a collar of green and bronze feathers. The tuft of silvery feathers on the forehead can be either erected, as represented in the engraving, or depressed flat against the skull, where it forms a triangle of regular shape with the apex forward.



SIX-PLUMED BIRD OF PARADISE. (PAROTIA SEXPENNIS.)

* The impossibility of giving all the features of this curious bird in a single illustration has led to its representation in a position which is quite possibly incorrect. As far as could be gathered from the natives, the enormous crest as it appears displayed during the courtship of the female is spread more widely, in the shape of a fan opened out to its fullest extent, and the pectoral shield being expanded in a similar manner, the head of the bird forms the center of an irregular circle of feathers of velvety black and emerald, which completely hides the rest of the body when viewed from in front.

How Mirrors Are Made.

One of the factories in Chicago employs some 150 men and boys, and its spacious four floors present an interesting series of sights to the visitors whose nerves are steel and tympani proof against splitting. On the first floor he will see huge stacks and piles of glass in assorted sizes, ranging from 16 feet by 7 feet squares down to the smallest ovals for mirrors. These are all polished, some being run over huge felt covered wheels kept powdered with rouge, and the larger sheets scrubbed by sweating toilers with hand blocks covered with felt like a printer's proof planer in rouge. After the glass is thoroughly polished it is taken up to the next floor, where it is laid on tables and cut into the sizes ordered. It then passes into the hands of the bevelers, who, with sand and water and large grindstones, artistically finish the edges of the glass. It takes a trip upward again, to another floor, and is once more put through a polishing process to remove any scratches or blemishes that may be on the glass. After every spot or scratch, no matter how minute, has been removed, careful hands convey the now beautiful and sparkling glass to the room where it goes through the final process, the silvering. Huge tables of cast iron or stone, made like billiard tables, with raised edges, are used in the silvering room. These tables are of great strength and solidity, and all around the edge is a drain, for the superfluous mercury is poured over the tables in quantities sufficient to float the glass, which, after being tinfoiled, is gently and carefully pushed across the table containing the mercury. Great care must be used to prevent blemishes, the least speck of dust being ruinous to the mirror. Mercury, like molten lead, is always covered with a dirty-looking scum which cannot be removed by skimming. The least bit of this scum would spoil the mirror, so the difficulty is obviated by shoving the scum along with the edge of the glass. After successfully floating the glass on the mercury, a woolen cloth is spread over the whole surface and square iron weights are applied until the whole presents a compact mass of iron, two or three pounds to the square inch. After this pressure has been confined for ten or twelve hours, the weights are removed and the glass placed upon another table of wood with a slightly inclined top. The inclination is gradually increased until the unamalgamated quicksilver has drained away and only the perfect amalgam remains, coating the glass and perfectly adherent. This ends the process, and the erstwhile rough piece of plate glass emerges from the silvering room a gorgeous mirror.—*Western Manufacturer.*

The Work Done by Machinery.

That locality and circumstance alone are true magicians in respect to their effects on the value of human labor is well known. In a manual by Mr. Alexander Wylie, entitled "Labor, Luxury, and Leisure," it is stated that on the vast farms of Dakota, the equivalent of one man's work, supposing the crop amount to 20 bushels to the acre, is 5,500 bushels of wheat. Now, keeping back enough for seed, we have here sufficient to produce 1,000 barrels of flour. This mass of food stuff can be carried through the flour mill and put into barrels, including the labor of making the latter, at the equivalent of one other man's labor for a year. Again, it has been worked out that at the ratio of the work accomplished by each man employed on the New York Central Railroad, the wheat can be transported to the flour mill and the thousand barrels of flour removed to New York, and all the machinery of the farm, the mill, and the road be kept in full "going order," for an equivalent to the whole labor of two more men. It comes, then, to this: that one thousand barrels of flour, the annual ration of one thousand persons, can be placed in New York from a point 2,000 miles away with the exertions of only four men working one year in producing, milling, and transporting the wheat. Further, this staple food can be baked and distributed by the endeavors of three more persons. It follows, then, that just seven persons can supply one thousand with the staff of life.

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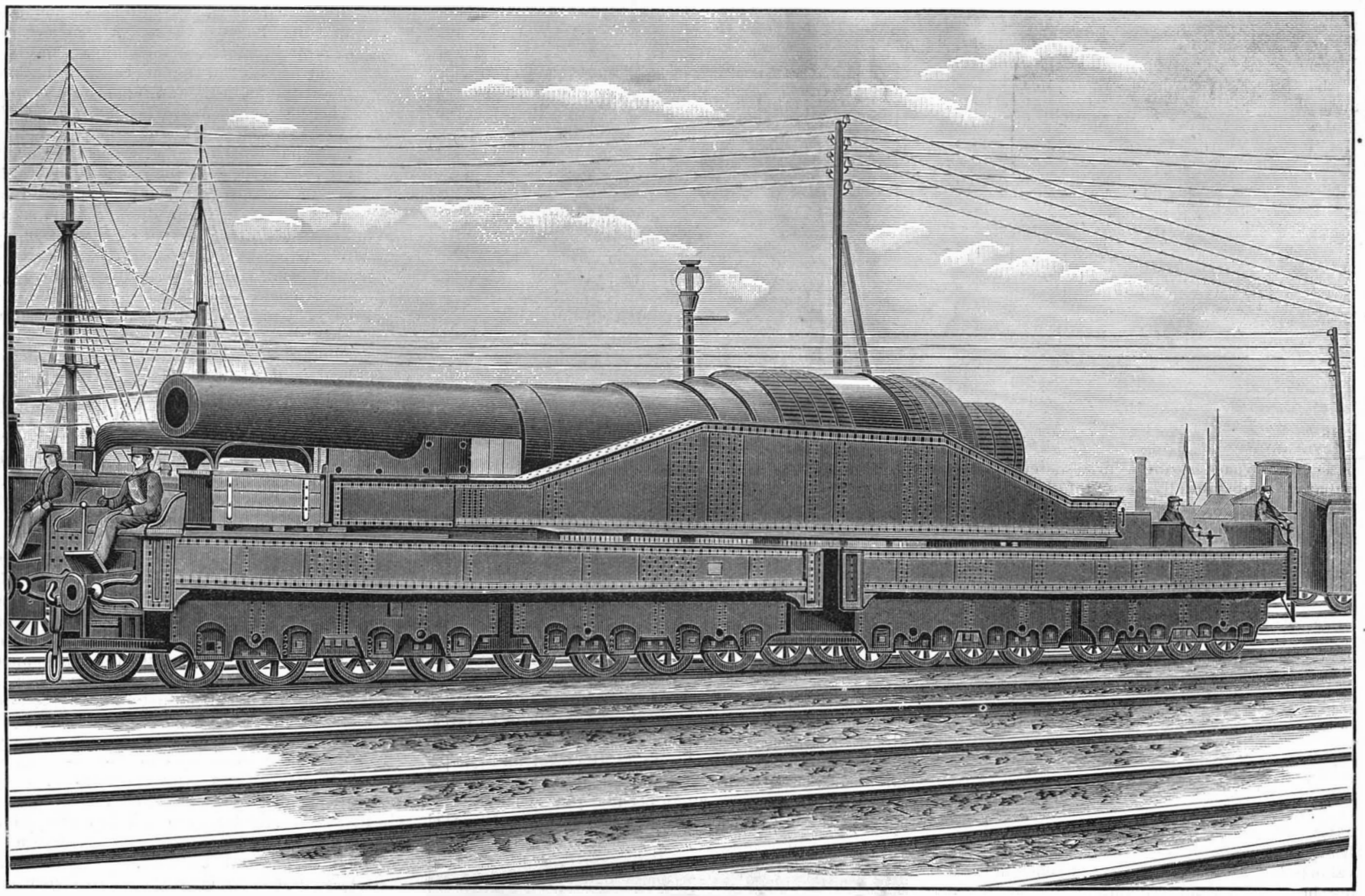
KRUPP'S GREAT GUN FOR THE ITALIAN NAVY.

The great German manufacturer of steel and of the most powerful artillery, Herr Alfred Krupp, who died on July 14, had in hand at Essen, for two years past, a gun constructed for the Italian Navy which is the largest hitherto produced. We give an illustration of this huge piece of ordnance, as it appeared when placed on a special railway wagon for conveyance to Antwerp, where it was put on board ship to be carried round into the Mediterranean, consigned to the Italian naval arsenal at Spezia.

The railway truck, built expressly for this purpose, was 75 ft. long, with thirty-two wheels and sixteen axles; but its length could form bendings, at six points, to pass round curves on the line of rails; this carriage, without its load, weighed ninety-six tons. The gun, which weighs a hundred and eighteen tons, is 45 ft. long, and its internal caliber is nearly sixteen inches, rifled with ninety-two spiral turns. It throws a steel projectile weighing nearly one ton, with a charge of six cwt. of brown prismatic powder, having an initial velocity of 614 yards in a second and a range of nearly eight miles. The shot can penetrate a steel armor plate thirty-six inches thick immediately at the mouth of the gun, and a plate twenty-nine inches thick, it is estimated, at the distance of a mile or more. It is believed that no armor-plated ship in the world can endure the fire of such powerful guns. Krupp's factory, however, is now engaged in making two of still larger dimensions.—*Illustrated London News.*



KRUPP'S LATEST GREAT GUN, PLACED ON THE RAILWAY FOR CONVEYANCE TO THE ITALIAN NAVAL ARSENAL AT SPEZIA

Brotherhood of Locomotive Engineers.

A public meeting of the brotherhood was held at Boston, Sept. 18, at which there were 3,500 people present. This organization meets the approval of the railway officials, and is conducted in a sensible, business-like manner, conducive of benefit to its members and harmony and good will between the employer and employed. The State and Boston city governments were represented, and interesting addresses were made by Lieutenant-Governor Brackett, Grand Chief Engineer Arthur, Railroad Commissioner Kinsley, Congressman P. A. Collins, and others. During the course of his remarks Mr. Arthur stated that since the benefit association was established $2,159,000 had been paid to the widows and orphans of deceased members of the brotherhood.

The Railroad Gazette gives the following extracts from Chief Engineer Arthur's address:

"It has been my privilege to meet nearly all the railway managers on this continent, and I want to say here that I have not met one within the past ten years who has not indorsed our brotherhood and approved of our course. . . . It takes time to acquire friends. . . . I want to speak of the policy of the brotherhood in dealing with disputes for the benefit of other labor organizations, some of whose members may be here to-day. I want to speak of our policy, and let them judge if it is not the best one. On all well regulated roads we have what we call a grievance committee. My advice is to select as members of that committee men of judgment, cool heads and clear brains, men who have been in the service of the company for years, and who are known to the officers of the road. I am sorry to say that my advice is not always followed. To that committee are referred the grievances of the men. After they have exhausted their own efforts to effect an adjustment with the company, the committee waits upon the officials of the road in rotation, beginning at the lowest grade. . . . By this policy we have settled every case except that of the Brooklyn Elevated.

"The officer of the brotherhood second in authority exhausted every honorable effort, but General Manager Martin refused to meet the men, and discharged the grievance committee. I hold, notwithstanding his legal right to do that, he insulted the entire brotherhood. All that was left for the men to do was to quietly submit or leave the service of the company, or, in other words, 'strike,' if that suits you better. The men struck and were whipped. These are the facts. When a general manager refuses to treat with his men and recognize their rights, he takes a position which is untenable, and he ought not to be sustained or retained in any position of authority upon a railroad. The solution of difficulties between employer and employed is in bringing the two parties together and having them sit down and talk the matter over."

Lightning Rods.

Many accidents are upon the record which have been due to the bad construction of lightning conductors, churches being the most notable sufferers from this cause. The history of St. Bride's Church, in Fleet Street, London, affords a curiously complete illustration of the need of lightning conductors for lofty buildings and of the need also that those conductors shall be good ones. On a Sunday afternoon in June, 1764, fourteen years after Franklin's discovery of the identity of lightning with electricity, but several years before St. Paul's Cathedral, the first public building in England to be so protected, was surmounted by a pointed lightning conductor, an intensely vivid flash of lightning struck St. Bride's beautiful steeple. The metallic weather vane and the iron bars by which it was supported safely conducted the current some distance down the steeple, but at the spot where the bars terminated a number of huge stones were shattered into fragments. Other metal work afforded a broken path for the current, but the intervening stonework suffered great havoc. Ninety feet of the steeple had to be taken down entirely, while great and expensive repairs were required for the rest. Many years afterward the steeple was again struck, and although a lightning conductor had in the interval been erected, it was so faulty in construction that at various points the church was once more damaged. In the storm which occurred at midday on July 15 last, St. Bride's a third time proved an irresistible attraction to the electricity of the heavens. Fortunately, upon this occasion the church itself was uninjured. The conductor conveyed the current to earth, but the contact was insufficient. There was a bad joint just below the spot where the rod entered the ground, and, as the dissipation could not take place with sufficient rapidity, a number of flagstones and a portion of the earth was torn up and sent flying to some distance. At least three churches in the metropolitan district—Christ Church, Endell Street, Long Acre; St. John's, Walham Green; and Holy Trinity, Tulse Hill—were struck and damaged recently, and a large number of buildings of various kinds, in London and the provinces, were set on fire by the lightning.

From the circumstances related it will be seen that even in this age of advanced acquaintance with physical forces, knowledge is singularly confined and its practical application in a most beneficent direction limited to a degree that is lamentable. In the face of the rate at which our great buildings, of private as well as of public character, are multiplying, the apathy which prevails in regard to their safety from lightning is remarkable, but possibly it is accounted for by the fact that thunderstorms are of short duration and occur only at long intervals.—*Elec. Review.*

The Ship Canal between Manchester and Liverpool.

The Manchester Ship Canal Company lately held their fourth half yearly meeting at Manchester. The directors reported that the contract for the work had been allotted to Mr. T. Walker, for 5,750,000*l.*, and that the purchase of the Bridgewater Canal and Mersey and Irwell navigations had been completed. It was stated that the works would very shortly be commenced, and it is hoped that either the Queen or Prince of Wales will lay the stone of one of the docks.

Sulphate of Iron for Moss.

Dr. A. B. Griffiths, F.R.S., has shown that iron sulphate completely destroys moss in grass lands without destroying the grass. According to M. Marguerite-Delacharlonny, of Paris, 250 to 350 kilogrammes of $FeSo_4$ for every hectare suffices. Dr. Griffiths also finds that the ferrous sulphate will also destroy parasitic fungi; and experiments are in progress to test its value as a manure for vines.

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A Furnace Patent Decision.

Judge Blatchford, of the United States Circuit Court for the Northern District of New York, has recently rendered a decision in a suit involving a certain construction of hot air furnaces which is of much importance to the trade. From a report in the Utica *Observer*, we learn that it was a test case, and would, had the decision been the other way, involve several of the largest furnace manufacturing concerns in the country.

The Palace King furnace is manufactured under what is known as the Goodenow & Owen patent by Russell Wheeler, Son & Co., of Utica. In October last this company brought an action in the United States Circuit Court for the Northern District of New York against the firm of H. Gilbert Hart & Co, which firm is composed of H. Gilbert Hart, Frank T. Budlong, and Milton K. Merwin, manufacturers of a furnace known as the Royal hot air furnace. The complaint in the action alleged that the Royal hot air furnace was an infringement on the Palace furnace, and an injunction was asked restraining its manufacture and sale. The action also involved a demand that the manufacturers of the Royal furnace pay over to the complainants all profits derived from its manufacture and sale.

The action was thoroughly prosecuted, over four weeks being consumed in taking proofs, covering 500 pages of printed matter, or about 2,000 folios. The case came on for argument at the June term of the United States Circuit Court, held in Canandaigua before Judge Blatchford, of the United States Court. August 22, he filed his decision in the United States clerk's office in Utica, holding that defendants' furnace was not an infringement upon the Palace furnace manufactured by Wheeler & Co., and dismissing the complaint with costs.

The claim in the Goodenow & Owen patent upon which the suit was brought was as follows:

"A furnace having secured thereto a detachable radiator, which is provided with one or more horizontal flues opening from a dome leading from the furnace, and a circular or elliptical hot air chamber, having air passages leading from the horizontal flues to the smoke nozzle or exit pipes, substantially as and for the purpose set forth."

The text of Justice Blatchford's decision is as follows:

"The words of claim one of the Goodenow & Owen patent, 'a furnace having secured thereto a detachable radiator,' 'substantially as and for the purpose set forth,' requires, by reference to the description part of the specification, that the radiator shall not only be detachable, but shall be secured by the flange, N, the slots, N, and the lugs, O, which, as the specification says, securely lock it in position, it being made detachable by bringing the lugs opposite to the slots. The state of the art also requires this interpretation of the claim. As the defendants' furnace contains no such means of securing the radiator in position, there is no infringement, and the bill must be dismissed with costs."

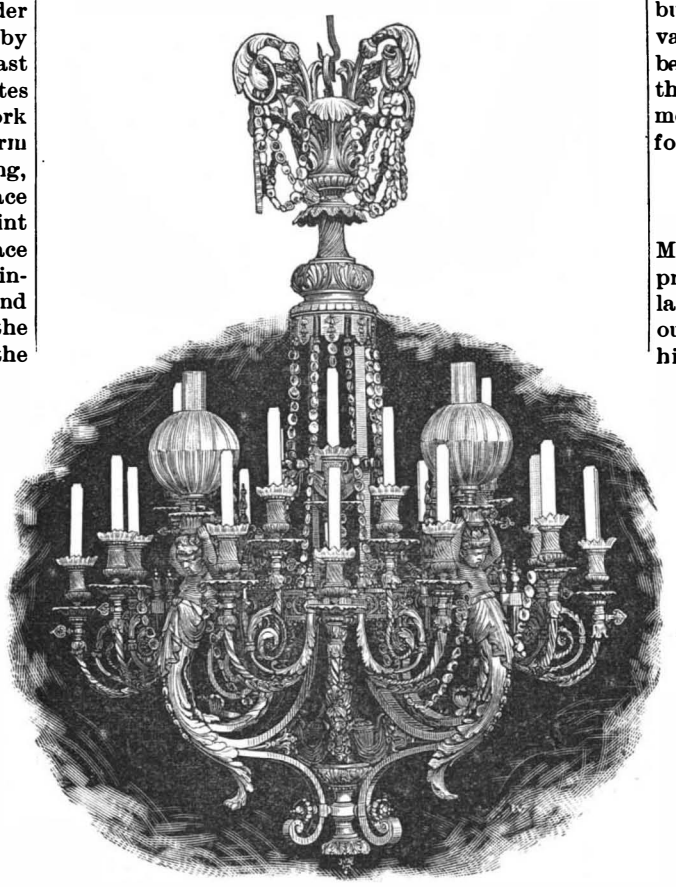
The Hop Louse.

Professor Riley, the entomologist of the Department of Agriculture, has made public the result of an exhaustive personal investigation into the habits of the *Phorodon humili*, or hop louse. His discoveries are expected to prove of great value to hop growers, as he has succeeded in learning the habitation of this plant pest during the winter months, and tracing it through the varying stages of insect life. Before the investigation, it was not known how or where the insect survived the winter. As a result of his inquiries, Professor Riley has satisfied himself that the eggs laid by the female at the close of the summer are deposited in plum trees, where the insect hatches in the spring, and resides until the third generation. This third brood, unlike its predecessors, is winged, and immediately after development abandons the plum tree and attacks the hop vine. In the autumn a counter migration from the hop vine to the plum tree occurs, the winter eggs are deposited, and the cycle of life goes on in the same way.

It is a notable fact that in regions where the cultivation of hop vines is a new industry, the growers have had complete immunity for a while from the pest. In California to-day they are not troubled by it. Professor Riley believes that the *Phorodon humili* has been brought to this country from Europe on plum stock; and there is reason to believe that the *Phylloxera*, the dreaded grape pest, was carried from this country to Europe on grape vine cuttings. Therefore California hop growers are warned to beware of importing plum stock from eastern hop regions. These discoveries render it possible to check the ravage of the hop louse either by the use of insecticides in the spring time, before the insect has reached the winged state, or by the destruction of the sheltering plum trees. The experiments will be continued with a view to protecting the hop vines after they have become infected.—*Science.*

FINE BELGIAN METAL WORK.

In the accompanying illustration is represented a specimen of beautiful work in bronze gilt, executed in Liege, Belgium. Its rich and elaborate ornamentation and brilliant gilding make it a most conspicuous feature even in such gorgeous salons as are to be found in French and Belgian palaces. Unlike our practice in the use of gas, this has been designed to be provided with

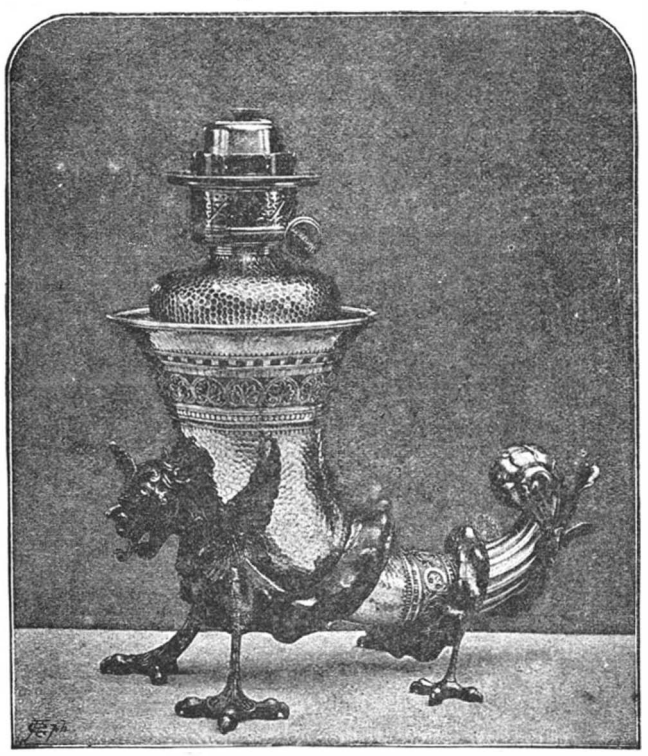


A BRONZE-GILT LOUIS XVI. CHANDELIER.

candles and the French mechanical lamps so much in use in Europe. This practice of illuminating salons being the almost universal custom in foreign countries, owing to the belief that the yellow light emitted is more becoming to the complexion than the more dazzling glare of gas or the electric light.

ARTISTIC WORK IN SILVER AND BRONZE.

The excellence of much of the work now executed by the leading American silversmiths is such that their productions unquestionably compare favorably with the best samples of foreign workmanship, while in all lines of plated goods our decided superiority over the manufactures of other countries will be readily admitted. Although every device is adopted whereby hand labor may be abbreviated, in the production of staple goods, expense is lavishly incurred in the getting out of new designs, and in the making of the most perfect steel dies for stamping, when the goods are thus formed, while in such articles as are cast such care is taken with the mould that they generally come out sharp and clean, and with an almost perfect finish.



LAMP IN SILVER AND BRONZE—ADAPTATION OF ORIENTAL DESIGN.

An ornamental lamp after a somewhat Oriental design, which presents no small difficulties in its execution, is shown in the accompanying illustration, and is the work of one of the best known of our manufacturing silversmiths. The dragon which forms the stand is of bronze, its serpentine body being wound around the horn, which forms the reservoir, and its crested head and wings, coming under the portion of the lamp bearing the greatest weight, give a proper sense of solidity, its claws furnishing the feet. The horn is of hammered silver, or of copper plated, oxidizing the silver making a most effective contrast and affording an article which will be very serviceable while needing but little care. The finish of this piece, and of a great variety of work of similar character, leaves nothing to be desired. In all such work the American public has the opportunity of obtaining goods of real artistic merit in a wider variety of design than they can be found anywhere abroad, and at a moderate cost.

Albuquerque, New Mexico.

The geographical location of this region of the Rocky Mountains is such as to exclude the possibility of the presence of moisture from either ocean or any other large body of water. The air is so pure and clear that our perception of distance seems to be almost annihilated, the mountains, some twenty miles to the east, appearing only two or three miles distant. The bodies of animals dying on the plains dry up, becoming mummified. May we not have here the ideal long sought for by every surgeon—a pure *aseptic* atmosphere, entirely free from germs? Bright, sunny skies, some portion of the day, is the rule even during the rainy season; two or three pleasant days often intervening between the showers. The winters are extremely mild. The ground was not covered with snow a single day during the past winter. During the past seven months there were only *four* entirely cloudy days—a land of almost perpetual sunshine, it even being extremely comfortable, throughout the winter months, to sit outdoors many hours of the day and enjoy the luxury of a mid-winter sun bath.—*Dr. T. J. Cummins, in Medical Record.*

The New United States Steamer Boston.

The new war cruiser Boston made a successful trial trip on the first instant, over the waters of Long Island Sound. 4,264 h. p. was developed and a speed of about 16 miles an hour attained. This is one of the ships built by the late John Roach. The substantial construction of the vessel and the superior character of her machinery were conspicuously shown on this trial, and do credit to the memory of her builder.

Alum for Bad Water.

The use of alum to clear muddy water has long been known, but Professor Leeds, in the course of an investigation on an outbreak of typhoid fever at Mount Holly, discovered another value in the use of alum, which, if his observation proves correct, may be very important. He found that the water which was supplied to the inhabitants of Mount Holly was swarming with bacteria, about fifteen drops being capable of forming 8,100 colonies of these microscopic vegetal germs when spread upon a suitable surface. He tried the experiment of adding a minute amount of alum to this water in the proportion of only half a grain to a gallon, and found that not only was the dirt and coloring matter precipitated, but that instead of the same quantity of water containing 8,100 colonies of bacteria, it contained only 80, and these were all of a large form.

On filtering the water through two thicknesses of filtering paper, he found that the filtered water contained no bacteria, but was "as sterile as if it had been subject to prolonged boiling." This amount of alum is too small to be evident to the taste, and is not harmful to health. If his observations shall remain unrefuted, they may form a valuable method of purifying polluted drinking water. Of course it does not follow that, because bacteria are removed, therefore the obscure cause of diseases due to impure drinking water is also removed; but bacteria and these diseases appear to be coincident, even if not linked almost as cause and effect, according to modern theories, and it is not too much to hope that, if the bacteria are removed, the virus of these diseases will be removed with them.—*Public Ledger.*

Adulterated Flour.

Adulteration of flour by means of potato flour may be detected by means of acids. Take a spoonful and pour upon it a little nitric acid; if the flour be of wheat, it will be changed to an orange yellow; if wholly of potato flour, the color would not be altered, but the flour formed into a tenacious jelly; if therefore the flour be adulterated with potato flour, it will not be difficult to decide. Again, take a spoonful of the flour, and pour upon it a little muriatic acid; if the flour be of pure wheat, it will be changed to a deep violet color, without odor; but if potato flour be mixed in it, it will then have an odor like that of rushes.

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Sneezing.

At a recent meeting of the Physiological Society, Berlin, Dr. Sandmann spoke on respiratory reflexes originating in the nasal mucous membrane. In order to study the possible connection between asthma and diseases of the nose, which has been so often supposed to exist, the speaker has made experiments on the respiration in rabbits and cats whose nasal openings had been completely occluded. In addition to confirming the phenomena which had been already described by earlier observers, he found that the changes in volume of the thorax were the same as in normal animals, whereas the intra-thoracic pressure was considerably increased when breathing was carried on entirely by the mouth; similarly, the respiratory undulations of the blood pressure tracing were increased in amplitude. He next investigated more closely the respiratory reflexes which originate in the nasal mucous membrane; of these three are known, namely, inhibition of respiration, sneezing, and coughing, as a result of stimulation of the nose. Inhibition of respiration was observed to occur, according to the strength of the stimulation, either in the phase of expiration or of inspiration, or merely as a more pronounced expiration. Sneezing was brought about by tickling the nasal mucous membrane, and was found to consist of a deep inspiration with simultaneous closing up of the pharynx and mouth by the application of the tongue to the palate, followed by an explosive expiration. When the stimulation is slight, only the deep inspiration is produced; if the stimulation is strong, the deep inspiration is followed by a somewhat lengthy inhibition of the same, which is frequently accompanied by slight expiratory movements; when the stimulation is of moderate strength, an ordinary sneeze is the result. After section of the phrenic nerves the deep inspirations were no longer observed. Dr. Sandmann, by section and removal of the mucous membrane in rabbits, has further examined the various regional areas of the same, and found that sneezing can only be produced by tickling a limited area of the mucous membrane. On the rabbit this area is found in the entrance to the nose on the anterior surface of the lowest nasal muscle; but in addition to this place, the same reflexes may be produced by stimulation of the front part of the septum and roof of the nasal cavity. Sneezing cannot be produced by stimulation of any other portion of the nasal mucous membrane. In man the region of the posterior nasal openings is also connected with the reflexes involved in sneezing in addition to the regions mentioned above. An anatomical investigation of the areas whose stimulation leads to sneezing showed that they are supplied entirely by the ethmoid nerve. Stimulation of this nerve in the orbit was followed regularly by sneezing, which could therefore be produced to a certainty by stimulating the trunk of the nerve. The third kind of respiratory reflex —namely, coughing as the result of nasal stimulation— could not be experimentally produced in the cats and rabbits used in these experiments.

How to Teach a Pacer to Trot.

BY JOSEPH CAIRN SIMPSON.

Boots are applied, and there is little doubt that the improvement in the trotters of the present day is greatly owing to the more intelligent use of these adjuncts. Still it is manifest that boots and hoofs of the hind feet, extending above the coronet, on the pasterns, ankles, and shins, must, more or less, hamper the animal wearing them, and if the difficulty can be obviated by a change of shoeing, it will be a superior method of overcoming it. But if this change in the shoeing should give a wrong bearing, an unnatural set of the feet or limbs, the remedy would eventually be worse than the disease. The use of tips presents a better opportunity to modulate the action than is possible to accomplish with shoes without endangering the feet and limbs. An illustration, and one which has struck me with the greatest force, is the change in the action of the colt when first shod. He has been broken and driven some before anything is placed upon his feet, and his trainer will tell you that there will be a favorable change whenever he has the iron fastened to his hoofs. In ninety-nine cases in a hundred the result will be as predicted, and the shoes, weighing in the neighborhood of a pound each, will increase his speed by several seconds. I have found a tip of not more than six ounces to have the same effect. Again, a tendency to pace is overcome by a heavier shoe or the resort to something else which has been found to have an analogous effect.

One of the most successful trainers I ever knew in converting the pacer to a fast trotter informed me that to run the horse with feet weighted until he became too tired either to run or pace was the most effectual method he had ever found to overcome the propensity for the lateral manner of progression. This proves that a heavy shoe or heavy toe weight is inimical to speed, either running or pacing, but is adapted to the trotting gait, and the horse finding he can get along easier when thus encumbered naturally tends to relieve himself by adopting the action suitable to the changed condition, and that which, tired beyond endurance in the other paces, can be sustained at the trot. This is also further proved by the other methods which trainers employ to change the pace into the trot. The old plan was to strew the road with rails and ride the animal over it; another, to practice the horse through loose sand or deep snow; and lately, in Texas, a very fast trotter was converted by driving him on the beach when the water reached his knees. The latter method is evidently a very effectual one to cause the horse to bend his knees, and the theory of the effect of weight on the action and the practice coincide. It is manifest that the knees must be bent more to enable the horse to get through the water easily, for if the leg were pushed along, the resistance of the fluid would be great, consequently the horse soon learns to pick his foot up as nearly perpendicular as he can, and thrust well forward. The most approved theory is that the weight influences the action more strongly where the heaviest weight is placed, and with shoes made much heavier on the inner quarter, the striking of the knee will be more likely to follow, and a horse which hits his knee with an equal shoe will avoid it when the outside is made the heaviest. It will necessarily follow the adoption of this hypothesis that weight on the toe will have a greater influence on the action than the same amount distributed over the whole foot; and though the present form of the weight was invented to obviate the bruising of the heels from the older-fashioned kind, it was based on the scientific principle of the correlation of forces. Thus, a bullet with one hemisphere cast of a denser material than the other will fly in a curve, the shorter radius being on the light side. The lighter the side the greater will be the effect, and if the power could be applied so as to overcome the attraction of gravitation, such a ball would describe a horizontal circle.—*Live Stock News.*

Quicksilver Ores.

Speaking on the character of quicksilver deposits, Prof. S. B. Cristie, of the University of California, in his testimony in a recent case in San Francisco, says: Quicksilver deposits, as a general rule, are very different from those of the ores of other metals. Many other metals occur in well-defined fissure veins, so that there is no difficulty in following the ore, and in many cases of calculating beforehand the amount of ore in sight; but with the exception of the deposit at the Old Almaden in Spain, and to some extent the deposit at the Idria in Austria, the quicksilver deposits, particularly those of California, are characterized by a great and persistent irregularity, so that it makes the mining of these ores much more difficult than that of other metals. New Almaden is a striking example of this irregularity. It has often occurred in the history of the mine that there was none or scarcely any ore in sight, and it has often looked as though the mines must of necessity be shut down, and it has only been by the most careful and painstaking prospecting or dead work that it has been possible to keep up the production of the mine. Very frequently large bodies of ore will almost completely run out, and there will be visible in the face of the works only a slight coloration in the vein matter, which indicates that there is ore left in that particular place, and by following out this little spring of ore carefully it may lead into a large deposit. As a result of this, the workings of the mine are necessarily very irregular, and it requires the greatest skill on the part of the engineer in charge of the works to keep up a regular and steady output of ore. Many times in the past history of the mine, the prospecting work has not been carried on on a sufficient scale, and this largely accounts for some of the irregularities of the production of the mine in former times.

How to Increase the Adhesion of Locomotive Wheels.

At the recent meeting of the American Association for the Advancement of Science, in New York, Mr. Elias E. Ries read a paper describing some experiments made by him with a view of determining whether the increased traction observed on the Daft Electric Railway in Baltimore and Hampden was due to the passage of the current from the rails to the wheels. In these experiments he came to the conclusion that it was possible to increase the tractive force from 50 to 100 per cent by suitable arrangements, and he showed a model car in which the two front wheels were insulated from the axle, and the two hind wheels metallically connected with their axle and the body of the car. He employed alternating currents of low potential obtained from a transformer. The current was led by a rubbing contact into the right front wheel; from there it passed into the rail, going then into the right rear wheel, and by the left rear wheel into the second rail, passing along the latter into the left front wheel, where, by means of another rubbing contact, it was led back to the transformer. The author attributes the increase of friction between the tires of the wheels and the rails to a change of molecular structure and to the development of heat at the points in contact, both of which effects are dependent on the strength of the current. He proposes to increase the traction of locomotives by mounting a small alternate current dynamo and transformer, the transformer being necessary in order to produce currents of very great strength and low tension, which could not be economically done direct from the dynamo. The low tension current would be sent through the wheels and rails, a rheostat being inserted in the circuit, by which the amount of current and the increase of friction could be regulated. He suggests that this system may with advantage be employed on our elevated railways.

Origin and Progress of the Manufacture of Tin Plate.

Mr. P. W. Fowler Neath, at a recent meeting of the Iron and Steel Institute, gave some interesting information in regard to the history of the tin plate industry. Historic documents show that tin plate was known at the time of the wars of Alexander the Great in the Indies. Herodotus, 450 years before Christ, Diodorus Siculus, Aristotle, and Pliny all speak of tin and the use of it for preserving iron. The tin was extracted from the mines of Setis and St. Michael's Mount, and brought to the shores of the Channel to be carried through Gaul to Massilia (Marseilles).

At the beginning of the 17th century, the manufacture of tin plate was in a flourishing condition in Bohemia. In 1620, the Duke of Saxony established this industry in his states, and in 1665 it was in full prosperity, according to the testimony of Andrew Yarranton.

The plates were hammered by hand, and then pickled in sour barley water, for want of acid. This operation took several days, while with sulphuric acid it can be performed in a few minutes. The tin plates were packed in casks weighing 140 Prague pounds, and carried on the backs of animals over the mountains to Leipzig, or transported down the Elbe on sleds in winter.

From 1650 to 1680, at the instigation of Colbert, aided by Mr. Reaumur, who, like Yarranton, had visited Germany, an effort, which proved unsuccessful, was made to introduce the industry into France. Yarranton states that the iron trade was depressed in England in 1665. The importations from Sweden, Germany, and France lay heavy on the market, and the same was the case with Welsh tin, and so he conceived the idea of endowing his country with the tin plate industry, which he had seen so prosperous in Saxony. A syndicate was formed, but nothing was done until 1720, when Major John Hanbury established the first factory at Pontypool.

The following are the improvements that have been introduced into the industry since then:

In 1728, the plates began to be rolled at Pontypool, instead of being hammered as before. In 1745, a vessel filled with melted grease was used for heating and preparing the iron before tinning it. In 1770, coal was applied to the manufacture of the iron. In 1806, sulphuric acid was substituted for sour barley water for pickling the plate. In 1829, Mr. Thomas Morgan reheated the plates in closed cast iron boxes, instead of bringing them into contact with flames. In 1866, Messrs. Morewood & Sanders took out a patent for rolling tin plates as they came from the tinning crucible. In 1874, pickling apparatus were introduced. In 1875, the Martin-Siemens soft steel was substituted for Swedish iron. In 1883, appeared the Thomas soft steel.

The tin plate industry is now consuming 460,000 tons of English iron and steel a year that would be useless for the same purposes if it were not coated with tin.

In 1885, there were 96 tin plate works, with 320 rolling machines, and the mean production of each machine was 96 barrels per day. During this same year the production was 7,130,000 barrels, 5,230,000 of which were for exportation.

The manufacture of fruit and meat cans is enormous. Three million barrels give 875,000,000 of these. It is due to them that the entire world receives from the far West salmon from the Oregon, mutton from the plains of Australia, fruits of all sorts from California, lobsters from Massachusetts and Nova Scotia, oysters and peaches from Baltimore, sardines and green peas from France, pineapples from the Mauritius Islands, apricots from Lisbon, milk from Switzerland, preserves from Tasmania, and a host of products from foreign climes. These boxes have become a necessity to modern civilization.—*Revue Industrielle.*

The Sense of Temperature.

Dr. Goldschneider lately presented and explained to the Berlin Physiological Society plates illustrating the topography of the sense of temperature. The sense of heat and cold was determined for the whole surface of the body, and arranged in a series corresponding to twelve degrees of intensity. As a general result, it was found that the sense of cold is more extended than that of heat; that both senses are more developed on the trunk than on the extremities; that the sense of temperature is less acute in the median line of the body; that the distribution of this sense over the surface of the body is quite different from that of the sense of touch; and that the points of exit of the nerves possess little or no sense of temperature.

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ENGINEERING INVENTIONS.

A stuffing box has been patented by Mr. Erastus G. Medrick, of Middletown, N. Y. It has wedge-shaped packing rings held in a gland and operated on by a piston fitting steam tight, a ring surrounding the wedge-shaped packing rings, the invention being especially adapted for steam cylinders and steam chests.

A safety water gauge has been patented by Mr. Peter Barclay, of Winthrop, Mass. This invention covers a construction whereby the valves connecting a boiler with the glass sight tube will close automatically, and prevent the outward passage of steam and water, in case the sight tube should be accidentally broken.

A railroad rail has been patented by Mr. Samuel M. Jacobs, of New York City. It is designed more particularly for street railways, and is made with a lengthwise groove, and with lower or bottom recesses at intervals into which the groove opens, forming a guide to peripherally toothed or flanged car wheels, and being practically self-clearing of dirt.

A car brake has been patented by Mr. Edward B. Warren, of Plankinton, Dakota Ter. Combined with the brake levers is a swinging gear plate, a gear wheel on the axle, and means for throwing the gear plate in and out of gear, and other novel features, the brake being controllable from the locomotive, and being efficient when the train is moving forward or backward, in a straight line or on curves. The patent embraces the large number of twenty-four separate claims.

AGRICULTURAL INVENTION.

A combined plow and harrow has been patented by Mr. William P. Clark, of Elberton, Ga. The invention covers an implement having interchangeable parts which may be bolted together to form an A or V harrow, a right or left side harrow, or a cultivating plow.

MISCELLANEOUS INVENTIONS.

A button has been patented by Mr. Pierre A. Raymond, of Grenoble, France. It is a spring buttond esigned especially as a glove fastener, the invention covering an improved construction of a similar button formerly patented by the same inventor.

A perfumed artificial flower has been patented by Mr. Solon Palmer, of New York City. It has a pervious receptacle adapted to contain a perfuming powder and concealed within the petals of the flower, the stem of the flower extending into the mouth of the receptacle.

A galvanic battery has been patented by Mr. Horatio J. Brewer, of New York City. The invention consists of a method of filling and packing the electro-negative material in a bag tightly around the carbon electrode, and maintaining a firm contact between the electrode and the electro-negative material.

A pendulum level has been patented by Mr. Oscar B. Fuller, of Burlington, Kansas. This invention relates to angle-measuring implements wherein a pendulous bob determines the vertical line, and affords a simple and improved construction, to increase their sensitiveness and accuracy and to render them more convenient in use.

A churn dasher has been patented by Mr. Lewis D. Bunce, of Salt Lake City, Utah Ter. The dasher blades are secured on a vertical dasher shaft by means of radial wings projecting from the shaft, the wings being formed on the shaft at a small cost, and forming a simple and efficient means of securing the blades thereto.

An inhaler has been patented by Messrs. Edgar S. Werner, of New York City, and John P. S. Gifford, of Chatham, N. Y. It has a casing with inhaling and exhaling tubes, and provided upon the inside with a coiled wire for holding sponges out of contact with the interior of the casing, in combination with mouth and nostril tubes connected to the casing.

A pavement has been patented by Mr. Elwin A. Snow, of Jacksonville, N. Y. It is preferably made of cast iron, and consists of a series of plates or blocks, with supporting bars on their under surface, with means for locking the plates together, making a pavement which can be readily and quickly laid, and will be durable and self-supporting over uneven ground, ditches, etc.

A machine for printing oil cloths, etc., has been patented by Mr. George Davison, Jr., of Brooklyn, N. Y. The invention covers a novel construction and combination of parts for a machine capable of printing any number of colors upon any width cloth, and in which the print rollers are made sectional upon a central shaft, whereby they may be adjusted to the width of the cloth.

A documental file has been patented by Mr. John M. Willis, of New York City. It has separable front and back flaps and a number of detachable backs of variable widths for connecting and holding the flaps at different distances apart, rendering documents inaccessible to dust, moisture, etc., and being particularly adapted to receive and preserve legal documents.

A magnetic register connection for water meters has been patented by Messrs. Albert S. Dietzman and George Cressey, of Louisville, Ky. This invention utilizes a permanent magnet moving in the water with the mechanism of the meter, and influencing, through the walls of the case, an armature with contacts controlling an electric circuit outside of the meter case.

A lumber assorter has been patented by Messrs. Horace B. Phillips and William M. Whaley, of Suffolk, Va. The machine comprises a series of guideways with receiving ends near the trimming sawe, and extending away to separate points of delivery, the guideways having actuated rollers at the bottom, upon which the lumber rests and is moved away, in connection with various novel features.

A water heater has been patented by Mr. Henry Stutsman, of East Portland, Oregon. It is for use in connection with stoves, ranges, etc., and combines with a reservoir a cylinder connected at top and bottom therewith, the cylinder having radial tubes, etc., to provide for heating a large quantity of water, and give a good circulation thereto, without any extra expenditure of heat.

A wagon end gate has been patented by Messrs. Robert R. Tichenor and Philetus Walker, of Henning, Minn. The side boards of the wagon have apertured plates, with flanges on their rear edges, and threaded shanks on their lower ends extending through the bottom of the wagon, and there are other novel features, so that the end gate may be readily removed and replaced, and will securely bind the ends of the side boards of the box.

A cactus singer has been patented by Mr. Ernest W. Vacher, of Derby, Texas. It is an apparatus which can be conveniently carried, and has an oil reservoir and a burner with a wire cloth to which just sufficient oil is supplied for each occasion of use, the flame being forced out through a narrow opening of the burner to a height of two feet if desired, the device being inexpensive, and one which can be used without danger.

A machine for forming veneer drums has been patented by Messrs. Wilson Godfrey and George W. Halstead, of Brooklyn, N. Y. The invention consists of the combination with a forming cylinder of two curved jaws adapted to fold the veneer around it, means for lifting the forming cylinder, which is formed with a recess combined with special clamping mechanism for binding the lapped edges of the veneer, with other novel features.

A cloth-cutting machine has been patented by Mr. Thomas W. Parshall, of Brooklyn, N. Y. It consists of a very thin endless belt knife mounted in a light base and upright, motion being communicated by a light belt from a flexible shaft or otherwise, the opposite sides of the belt blade running close together in opposite directions, and the base being made of convenient shape to be slipped readily under a pile of cloth to be cut, the edges of which are thus brought against the two opposite moving edges of the belt knife.

A gas regulator has been patented by Mr. Cary Pattrell, of Derrick City, Pa. Combined with a T coupling, having a valve seat to one side of its inlet opening, is an expansible casing connected to the end of the coupling opposite the valve seat, a stuffing opposite the valve seat, a stuffing box in alignment with the valve seat, and a screw stem passing through the stuffing box and casing into the coupling, with other novel features, for automatically regulating the quantity and pressure of the gas.

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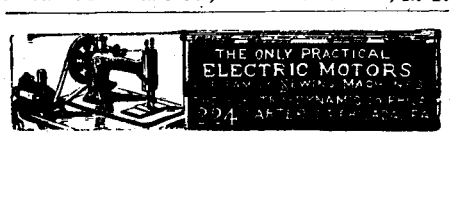

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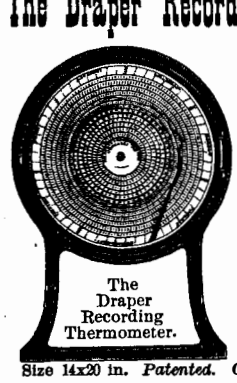

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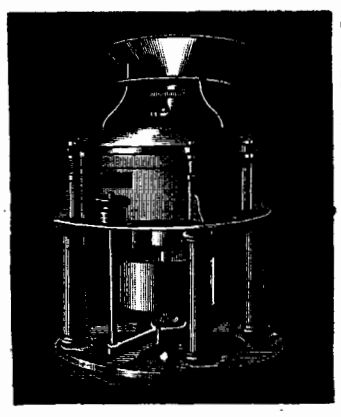

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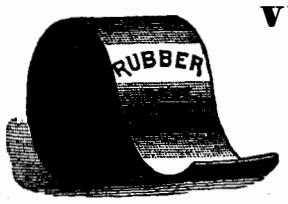

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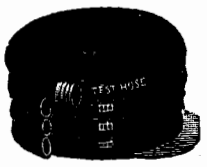

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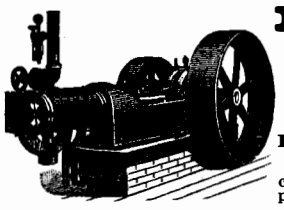

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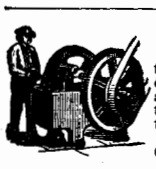

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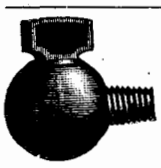

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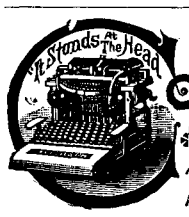

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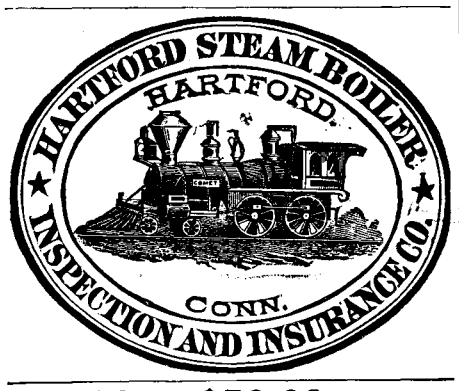

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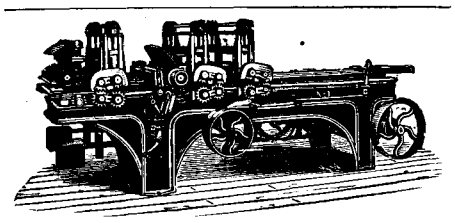

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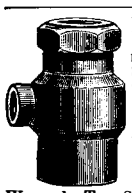

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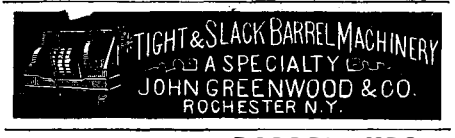

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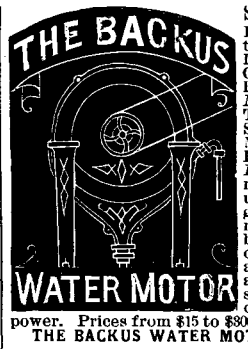

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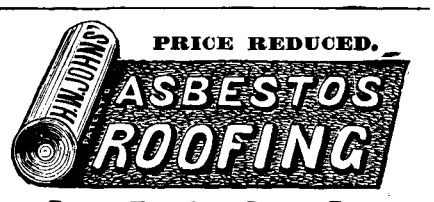

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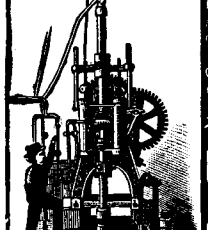

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